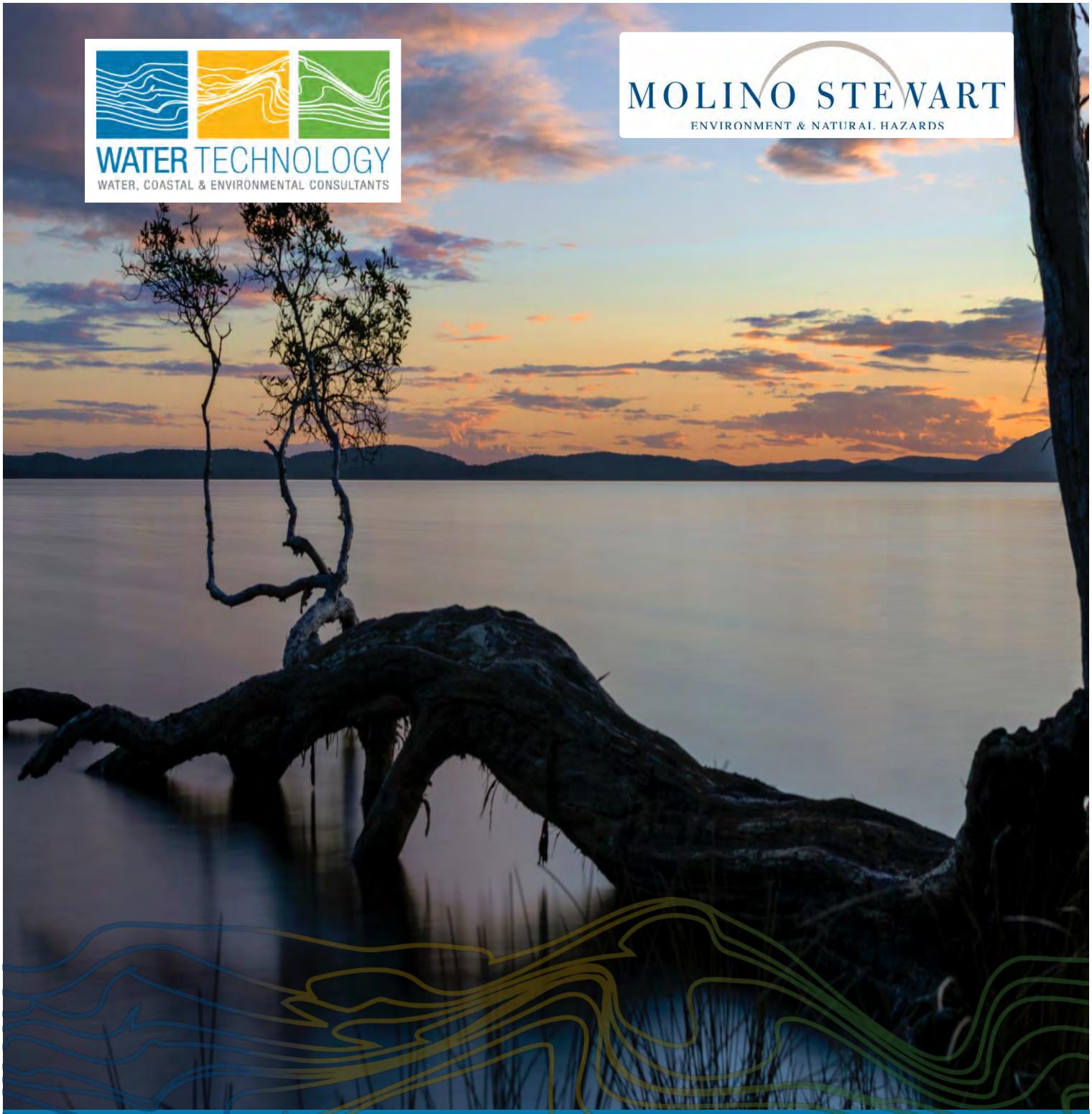

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

Final Report

Stage 1 Scoping Study: MidCoast Southern Estuaries Coastal Management Program

MidCoast Council

14 October 2022

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Acknowledgement of Country

We acknowledge the traditional custodians of the land on which we work and live, the Gathang-speaking people and pay our respects to all Aboriginal and Torres Strait Islander people who now reside in the MidCoast Council area. We extend our respect to elders past and present, and to all future cultural-knowledge holders.

EXECUTIVE SUMMARY

The MidCoast Local Government Area (LGA) contains several iconic and highly valued estuaries, including the largest coastal lake system in NSW. The southern estuaries study area includes Khappinghat Creek, Black Head Lagoon, Wallis Lake, Smith Lake, Myall Lakes, the northern foreshores of Port Stephens (including Karuah River, North Arm Cove and Kore Kore Creek), and their contributing catchments. This coastal area provides stunning natural environments, areas of cultural significance, a multitude of social and recreational benefits for the local communities and visitors and is a key contributor to the regional economy. However, the coastal zone is facing increasing pressure from environmental stressors, population growth, urban development, and climate change.

Why Develop a Coastal Management Program (CMP)?

Under the NSW Coastal Management Framework, MidCoast Council (Council) is preparing a series of Coastal Management Programs (CMPs) that will establish integrated, long-term programs for the coordinated management of the coast to maintain and enhance their environmental, social, and economic values. The CMP addresses current and future risks and aims to enhance the coordinated management of the coastal zone across local and state government agencies. It updates and supersedes existing Estuary and Coastal Zone Management Plans in the study area.

The CMP seeks to achieve the objectives of the *Coastal Management Act 2016* through a program that will identify coastal management issues, pressures, and risks. It further develops a strategy to address these risks in a cost-effective and sustainable manner through an integrated forward program and provides a robust and defensible platform to secure funding from the NSW Government's Coastal and Estuary Grants Program.

CMP Scope

The spatial scope of this CMP includes the estuaries between Port Stephens and Wallabi Point in the MidCoast Local Government Area (LGA), including the estuaries and catchments of Khappinghat Creek, Black Head Lagoon, Wallis Lake, Smiths Lake and Myall Lakes, along with the northern foreshore of Port Stephens.

This Scoping Study represents the first of five stages in the CMP process. It has been prepared on behalf of Council with funding and technical support from the NSW Department of Planning and Environment (DPE), and in consultation with various state agencies and other relevant stakeholders. This study has reviewed the history of estuary management, demonstrated a shared understanding of the current situation, and outlined a forward program for the remaining stages, which comprise:

- Stage 2: A detailed assessment of risks, vulnerabilities and opportunities;
- Stage 3: Identification and evaluation of management actions;
- Stage 4: Preparation, exhibition and adoption of the CMP; and
- Stage 5: Implementation, monitoring and evaluation.

Community and Stakeholder Engagement

The development of the CMP includes extensive engagement with the local communities, Indigenous peoples, and other stakeholders including representatives from relevant government agencies throughout the entire program. Local communities and other key stakeholders have been directly consulted as part of this Scoping Study, particularly in relation to the perceived values, threats and risks to the study area. A Community and Stakeholder Engagement Strategy has also been prepared by Council for the remaining stages of the CMP, in accordance with the requirements of the NSW Coastal Management Manual.

The Values of the MidCoast Southern Estuaries

The Scoping Study identifies a range of environmental, social and economic values provided by the coastal zone. Some of the most highly rated values identified by the community survey included sustaining healthy

estuarine environments that support biodiversity, good water quality that supports ecosystems and recreational uses, scenic and recreational amenity.

The Study shows that the estuaries are highly valued for the healthy and diverse ecosystems that they provide, supporting biodiversity that is important from national, regional and local perspectives. This includes the Myall Lakes which were designated as a Wetland of International Importance under the Ramsar Convention, and are protected by conservation reserves managed by the NSW Government. Estuarine water quality is also highly valued throughout all study area estuaries and considered a general indicator of estuary and catchment health by the local communities and stakeholders. Good water quality is generally related to overall positive outcomes in terms of the ecological condition of waterbodies, visual amenity, primary and secondary contact recreation, and irrigation water supply.

These estuaries support a range of highly valued community uses and recreational opportunities, such as nature observation, exercise, relaxation, swimming, watercraft activities, and recreational fishing. The local communities place significant value on safe and sustainable access to the estuaries.

Furthermore, the MidCoast has a rich and continuing Indigenous heritage, with cultural history extending more than 60,000 years. The Biripi and Worimi people are the traditional custodians of the Great Lakes area having cared for and lived on Country for thousands of years. Indigenous heritage across the study area abounds, including camp sites, shell middens, scarred trees and burial grounds. The Aboriginal community continues to maintain a living cultural connection to country.

The estuaries also contribute to the local economy in many important ways. Oyster harvesting in Wallis Lake and Port Stephens dates back to the early 1880s and is an important driver for the local economy and major employer in the region. There is a vibrant and growing tourism sector driven by the abundant coastal areas and adjacent National Parks.

Pressures and Threats Facing the MidCoast Southern Estuaries

A review of historical management plans in the study area and a first-pass risk assessment has found that the estuaries are facing a number of pressures. It is expected that population growth, increased development and climate change impacts will result in a number of additional or emerging risks across the study area. Some of the key threats discussed in this study include:

- Catchment runoff, urban stormwater discharge and sewage effluent impacting water quality, particularly in more urbanised areas of the study estuaries. Urban runoff often contains a range of pollutants including sediment, nutrients, heavy metals, hydrocarbons, chemical compounds, and gross pollutants. Areas of concern include Pipers Creek and Wallamba Cove in Wallis Lake. The Upper Karuah River also has known issues caused by sewage and effluent runoff from further up the catchment. These issues can impact on human safety when interacting with these waterways, particularly after large rainfall events.
- Agricultural runoff in some parts of the study area poses a threat to water quality due to the inputs of nutrients and sediment from erosion. Key areas of concern are in Wallis Lake Myall Lakes and Karuah, which have significant agricultural, intensive poultry and dairyland uses in their catchments.
- Inundation of foreshore areas caused by one or a combination of coastal, riverine and tidal inundation can result in risks to ecosystems, built assets and human lives. It can cause inundation of property, public infrastructure and environmental assets around the estuaries.
- QX disease in Sydney Rock Oysters caused by parasites has been identified as a major threat to the oyster industry within the study area.
- Increased development and tourism can result in overcrowding of the waterways and user group conflict. A few anecdotal evidence has been reported to estuary officers within the council.

- The damage, loss, and/or disturbance of Indigenous tangible and/or intangible heritage is a risk, particularly considering sea-level rise, erosion along the estuaries, and future planned development across the study area.

Roles and Responsibilities

The Scoping Study included an audit of historical coastal management arrangements across the LGA. Governance of the MidCoast's estuaries is multi-layered, with the estuaries and waterways owned and managed by a wide variety of stakeholders across multiple levels of government. Key stakeholders include Council, DPE, NSW National Parks and Wildlife Service (NPWS), Crown Lands, the Department of Primary Industries - Fisheries, the Department of Primary Industries – Marine Parks, Transport for NSW, Hunter Region Local Land Services, and the Forster, Karuah and Worimi Local Aboriginal Land Councils.

The Way Forward

The Scoping Study has developed a business case and forward program for the CMP. The projected forward program for the CMP is provided in the table below, which includes indicative costings and timeframes for each stage. It is estimated that CMP will take around 1.5 years to progress through Stages 2 to 4. The fifth and final Stage will involve the ongoing implementation of each program over a 10-year period thereafter.

The CMP will be implemented through Council's IP&R framework, and its Community Strategic Plan, with implementation through its Delivery Programs and Operational Plans. This framework will guide the implementation of the CMP and ensure all required monitoring and reporting is completed. It will also provide a framework for the review and assessment of CMP outcomes.

CMP Stage	Cost Estimate	Indicative Duration	Indicative IP&R Delivery Plan	Indicative IP&R Operational Plan
Stage 2 – Determine Risks, Vulnerabilities and Opportunities	**$165,000-$210,000**	**3-6 months**	**2022-2026**	**2022/23**
MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment	$80,000 - 100,000	4-5 months	2022-2026	2022/23
Coastal Wetland Mapping and Condition Assessment for Wallis & Smiths Lakes	$50,000 - 60,000	4-6 months	2022-2026	2022/23
Risk Based Framework Assessment for Blackhead Lagoon and Khappinghat Creek	$35,000 - $50,000	2-3 months	2022-2026	2022/23
Stage 3 – Identify and Evaluate Options	**$85,000**	**4-6 months**	**2022-2026**	**2023/24**
Community and Stakeholder Engagement	$20,000	3 months	2022-2026	2022/23
CMP Management Actions Report	$65,000	3-5 months	2022-2026	2022/23
Stage 4 – Prepare, Exhibit, Finalise and Adopt CMP	**$50,000**	**5-7 months**	**2022-2026**	**2024/25**
Draft Coastal Management Program	$30,000	3-5 months	2022-2026	2024/25
Community and Stakeholder Engagement	$10,000	2 months	2022-2026	2024/25
Final Coastal Management Program	$10,000	1 month	2022-2026	2024/25
Total	**$300,000 - $345,000**	**12-18 months**	**As above**	**As above**

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1 INTRODUCTION

1.1 Background

The coastal zone of the MidCoast Local Government Area (LGA) is a major social, environmental, and economic asset for the state of New South Wales (NSW). The coastal zone provides a stunning natural environment, a multitude of recreational opportunities, and is also a key contributor to the "blue" economy that supports the local communities through various activities ranging from agriculture, aquaculture, tourism, and commercial and recreational fishing. Due to its large size, diverse, beautiful, and valuable resources, the management of the coastal areas within the MidCoast LGA requires an integrated approach.

MidCoast Council (Council) is preparing a suite of Coastal Management Programs (CMPs) that span the coastal zone of their LGA. This Scoping Study document represents the first of five stages of the CMP process for a program that will cover the estuaries of Khappinghat Creek, Black Head Lagoon, Wallis Lake, Smith Lake, Myall Lakes, and the northern foreshores of Port Stephens– hereby referred to as the *MidCoast Southern Estuaries*. The purpose of CMP will be to establish an integrated program for the coordinated management of the estuaries, to maintain and enhance their social, cultural, economic and environmental values.

Council is developing this CMP study with support from the NSW Department of Planning and Environment (DPE) in consultation with various state agencies and other relevant stakeholders. This report has been prepared in accordance with the requirements outlined in the NSW Coastal Management Manual (OEH, 2018a).

1.2 The NSW Coastal Management Framework

The NSW coast provides a multitude of values and uses for the community. However, the coastal zone is under increasing pressure from a growing population, urbanisation, natural hazards and climate change. Planning for coastal communities must carefully balance the need to provide jobs, housing, community facilities and transport for a changing population while maintaining the unique qualities and managing risks associated with development along the coastlines (OEH, 2018a).

Sustainable management of the coastal zone often involves local councils, their communities and public authorities balancing a diverse range of challenges and opportunities. The context is one of rapid environmental, social and economic change, along with dynamic coastal processes affecting the open coast, estuaries and coastal lakes (OEH, 2018a).

In order to plan for development, protect environmental assets and manage coastal hazards across the state, the NSW Government has implemented the *NSW Coastal Management Framework*, which includes new legislation and planning policy-and aims to provide an integrated framework for coastal management across the state.

Key components of the framework include:

- *Coastal Management Act 2016* (CM Act): An act that provides for the integrated management of the coastal environment of NSW, consistent with the principles of ecologically sustainable development, for the social, cultural and economic wellbeing of the people of the state.
- *Marine Estate Management Act 2014* (MEM Act): An act that provides for the management of the marine estate of NSW in a manner that promotes a biologically diverse, healthy and productive marine estate and which facilitates the economic, cultural, social and recreational use of the marine estate.
- Coastal Management State Environmental Planning Policy 2018 (CM SEPP): One of the key environmental planning instruments for land-use planning in the coastal zone. It gives effect to the

objectives of the CM Act 2016 and delivers the statutory management objectives of the Act by specifying how development proposals are to be assessed if they fall within the coastal zone.

- In December 2021, the Minister for Planning and Public Spaces announced that the 45 existing State Environmental Planning Policies (SEPPs) will be consolidated into 11 new amalgamated SEPPs. As part of this process, the CM SEPP has been rolled into Chapter 2 of the new State Environmental Planning Policy (Resilience and Hazards) 2021.
- The SEPP consolidation is administrative, and no policy changes have been made. The SEPP consolidation does not change the legal effect of the existing SEPPs, with section 30A of the *Interpretation Act 1987* applying to the transferred provisions. For clarity, these provisions are still referred to as the CM SEPP in this document.

- The implementation of CMPs: A five stage coastal management process intended to set the long-term strategy for the coordinated management of the coastal zone for a given area.
- The NSW Coastal Management Manual (The Manual): A manual that sets forth mandatory requirements and provides guidance to coastal councils in connection with the preparation, development, adoption, implementation, amendment, and review of CMPs.
- The NSW Coastal Council: Which is responsible for advising the Minister on coastal management issues, as well as reviewing and approving CMPs.
- The NSW Coastal and Estuary Grants Program: which provides technical and financial support to local governments to help manage the coastal zone.

A schematic of the NSW Coastal Management Framework is provided below (See Figure 1-1) .

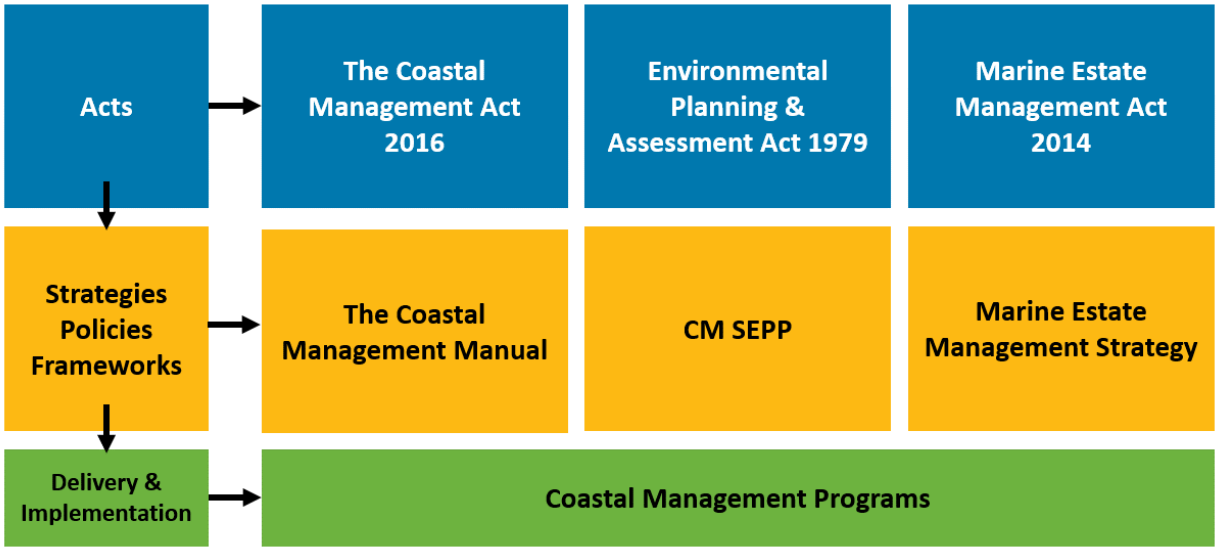

Figure 1-1 The NSW Coastal Management Framework

1.3 Coastal Management Programs

The purpose of a CMP is to set the long-term strategy for the coordinated management of the coastal zone of a given area. It should focus on achieving coastal management objectives at a local level, whilst also achieving the broader objects of the CM Act (OEH, 2018a). A CMP provides an opportunity for councils, public authorities and local communities to clearly identify and balance competing interests and priorities in the coastal zone.

A CMP is prepared through a five-stage risk management process, as described in the NSW Coastal Management Manual and depicted in Figure 1-2. This process is intended to help councils and their communities to identify and manage risks to the environmental, social and economic values of the coast (OEH, 2018a).

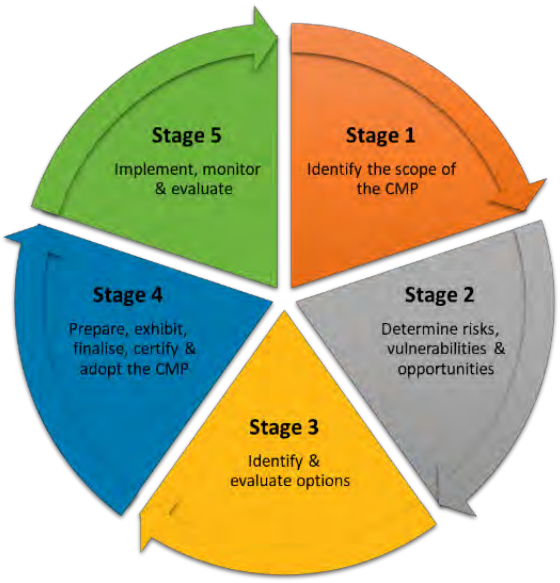

Figure 1-2 The CMP Process

MidCoast Council is commencing the CMP process for the Southern estuaries, and this Scoping Study is the first stage. The primary purpose of a Stage 1 Scoping study is to:

- Review the history of managing the coastal zone;
- Develop a shared understanding of the current situation; and
- Identify the focus of the future CMPs.

Stage 1 addresses the objects of the CM Act, builds on and integrates with previous work, including existing plans and strategies, technical studies and stakeholder input. It guides councils in formulating appropriate strategies and actions in later stages of the process and identifies future stages of CMP development that can be 'fast-tracked' (Stages 2 to 5).

1.4 The MidCoast LGA Suite of CMPs

Whilst this CMP sets out a management program for MidCoast southern estuaries, it is important to note that this is only one of several CMPs to be implemented across the MidCoast LGA.

In order to effectively manage its coastal zone, Council has determined to undertake a suite of four (4) discrete, but interlinked CMPs that collectively cover the coastal zone of its LGA, as depicted in Figure 1-3. This figure provides a broad indication of the CMP study areas – however the exact study areas are defined by the CM SEPP Mapping for each of the respective coastal management areas,

They comprise:

- ***MidCoast Southern Estuaries CMP (This CMP):*** which covers Khappinghat Creek, Black Head Lagoon, Wallis Lake, Smiths Lake, Myall Lakes and northern foreshore of Port Stephens (including Karuah River, North Arm Cove and Kore Kore Creek).
- ***The Manning Estuary CMP:*** which covers the coastal zone of the Manning River estuary commencing 2 km inland from the open coast.
- ***Old Bar / Manning Point CMP:*** which sets out coordinated and adaptive management actions to address coastal hazards specifically related to the Old Bar/Manning Point area.

- ***The MidCoast Open Coast CMP:*** which is intended to cover the open coast of the MidCoast LGA, which includes Tacking Point at Crowdy Head to Yacaaba Head. This CMP study area also includes Jimmys Beach.

An important consideration will be to ensure that the boundaries of adjacent CMPs are appropriately set to address the management issues. This means that the study areas of some CMPs may in fact overlap in certain areas. An example of this is estuary entrances – where the management of an entrance berm (for instance, Smiths Lake) would be most effectively covered in the estuary CMP – but management of the broader beach system would be covered in the Open Coast CMP. Based on this, it is clear that a coordinated and consistent approach to CMP development will be required to ensure that all of Council's CMPs form an integrated suite of programs.

It is also important to note the **Port Stephens Open Coast and Estuary CMP**, which is currently being developed by Port Stephens Council. The CMP sets out a long-term, strategic, coordinated and adaptive plan to manage ongoing pressures to the southern foreshore of the Port Stephens estuary and associated tributaries, as well as the open coastline in the Port Stephens LGA. It is understood that Port Stephens Council has decided to embark upon this CMP independently of the MidCoast Southern Estuaries CMP – however the two programs should include strong consideration of one another during development and implementation, in order to provide a holistic approach to estuary management for the Port.

This CMP will recognise but exclude detailed consideration of coastal zone areas that are already the subject of an existing or in-progress CMP.

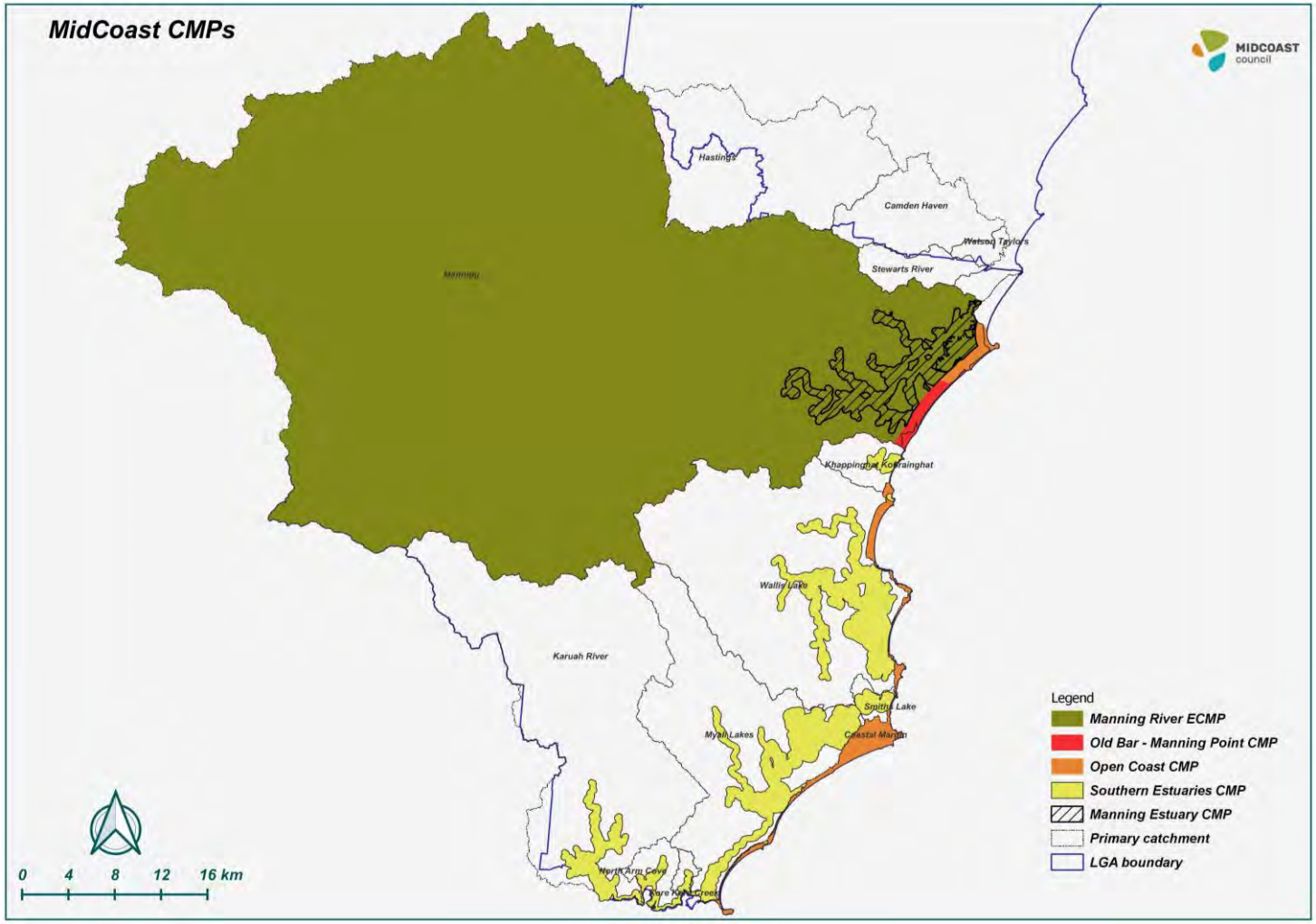

Figure 1-3 The MidCoast Council Suite of CMPs

1.5 Structure of this Report

This report meets the requirements of a Stage 1 Scoping Study set out in the NSW Coastal Management Manual. It includes the following components:

- Section 2 outlines CMP study area,
- Section 3 outlines the purpose, vision and objectives of the CMP;
- Section 4 provides the strategic context for the CMP, including background information regarding the local environmental processes, governance, applicable policy and management plans, as well as the social and economic use of the study area;
- Section 5 provides an overview of the stakeholder engagement activities undertaken during Stage 1, and those required during the remaining stages of the CMP;
- Section 6 summarises the existing coastal zone management plans in place across the estuaries;
- Section 7 details the roles and responsibilities and the proposed CMP governance structure;
- Section 8 details a first-pass risk assessment which identifies the major threats and pressures facing the study area;
- Section 9 provides a gap analysis and recommends further studies required to fill key knowledge gaps during Stage 2 of the CMP;
- Section 10 outlines a preliminary business case and possible funding mechanisms and
- Section 11 provides an overview of the forward program for completion of Stages 2 to 4 for the CMP.

Effective engagement and communication are important aspects of a successful CMP. A key component of this Scoping Study is the development of a Community and Stakeholder Engagement Plan (provided in Appendix A). This Strategy outlines which organisations should be involved in the preparation, review and implementation of the CMP, how they will be offered engagement opportunities and how their input will be incorporated into the planning process.

2 CMP STUDY AREA

2.1 The Study Area of the CMP

2.1.1 Legislative Considerations

The overall objects of CM Act seek to protect and enhance the environmental values and natural processes of the coastal zone. Where the coastal waters, estuaries, coastal lakes, and coastal lagoons are concerned, it is recognised that the health of coastal catchments is critical to the overall health of the coast and marine environment - including the social, economic and cultural benefits derived from good catchment health.

Therefore, best practice estuary management requires a "systems" approach that takes into account the important physical and ecological systems that extends across the catchment, coastline, estuaries and foreshore of the MidCoast southern estuaries – including water quality, ecological processes, hydrological and oceanographic processes, coastal and catchment flooding, development pressures and local and regional planning initiatives.

Whilst a catchment-based approach to estuary management is beneficial, there are some legislative considerations that affect the legally defined study area of the CMP. They are:

- Section 12 of the CM Act outlines the purpose of a coastal management program, being 'to set the long-term strategy for the coordinated management of land within the coastal zone with a focus on achieving the objects of this Act'
- Section 13(2) of the CM Act specifies that, 'a Coastal Management Program may be made in relation to the whole, or any part of the area included within the coastal zone'.

In considering the statutory requirements, there is no provision in the CM Act for land or actions to be included in a CMP, where that land or actions reside outside the "coastal zone" - which is legally defined in the CM Act as the envelope extent of the four coastal management areas mapped in the CM SEPP. The 4 areas that comprise the coastal zone are:

- The coastal wetlands and littoral rainforests area;
- The coastal vulnerability area;
- The coastal environment area; and
- The coastal use area.

These coastal management areas are discussed further, and mapped, in Section 2.4.

For the study area estuaries, it is acknowledged that the defined "coastal zone" is generally only a portion of the catchment. However, as is required under the CM Act, the focus of a CMP must be directed to activities contained within the defined coastal zone. For development of this CMP, the implications of this are:

- The study area of the CMP must be comprised only of the legally defined "coastal zone".
- Any actions that are to be included in the certified CMP document in Stages 4 and 5 must located within the legally defined "coastal zone".
- Whilst the CMP should describe areas outside the "coastal zone" (i.e., the broader catchment areas) and the effects these areas may have on land within the "coastal zone" - these areas should be distinguished from the area to which a CMP applies.
- Where Council intends to develop broader catchment-based actions that are located outside of the "coastal zone", then these actions should be captured in a separate document or addendum to the CMP,

and these must be clearly identified and distinguished from those actions that are to be delivered as part of the certified CMP.

2.1.2 Jurisdictional Considerations

An important consideration will be to ensure that the boundaries of adjacent CMPs are appropriately set to address the management issues. This means that the study areas of some CMPs may in fact overlap in certain areas. An example of this is estuary entrances – where the management of an entrance berm (for instance, Black Head Lagoon, Khappinghat Creek and Smiths Lake) would be most effectively covered in the estuary CMP – but management of the broader beach system would be covered in the Open Coast CMP. Based on this, it is clear that a coordinated and consistent approach to CMP development will be required to ensure that all of Council's CMPs form an integrated suite of programs.

It is also important to note the study area will also not cover the area of the Port Stephens estuary that are within the Port Stephens Council LGA. Those area will be covered in the Port Stephens Open Coast and Estuary CMP currently being delivered by Port Stephens Council. However, the two programs should include strong consideration of one another during development and implementation, in order to provide a holistic approach to estuary management for the Port.

2.1.3 Summary of the CMP Study Area

Based on the discussion provided above, a summary of the CMP study area (see Figure 2-1) is provided in Table 2-1 below.

Table 2-1 Summary of the CMP Study Area

Area	Included in the certifiable CMP Study Area:	Excluded from the certifiable CMP Study Area:
CMP Approach	Actions in this area can be included in the legally certified CMP	Issues is these areas are to be considered in relation to their impact on the "coastal zone", but actions located in these areas should be captured in a separate document or addendum to the CMP.
Khappinghat Creek Black Head Lagoon Wallis Lake Smiths Lake Myall Lakes Northern foreshores of the Port Stephens estuary – including Karuah River	The legally defined coastal zone comprising of: ■ The coastal wetlands and littoral rainforests area; ■ The coastal vulnerability area; ■ The coastal environment area; and ■ The coastal use area.	■ Broader catchment areas located outside of the legally defined "Coastal Zone" ■ Area of the Port Stephens estuary that are located outside of the MidCoast LGA

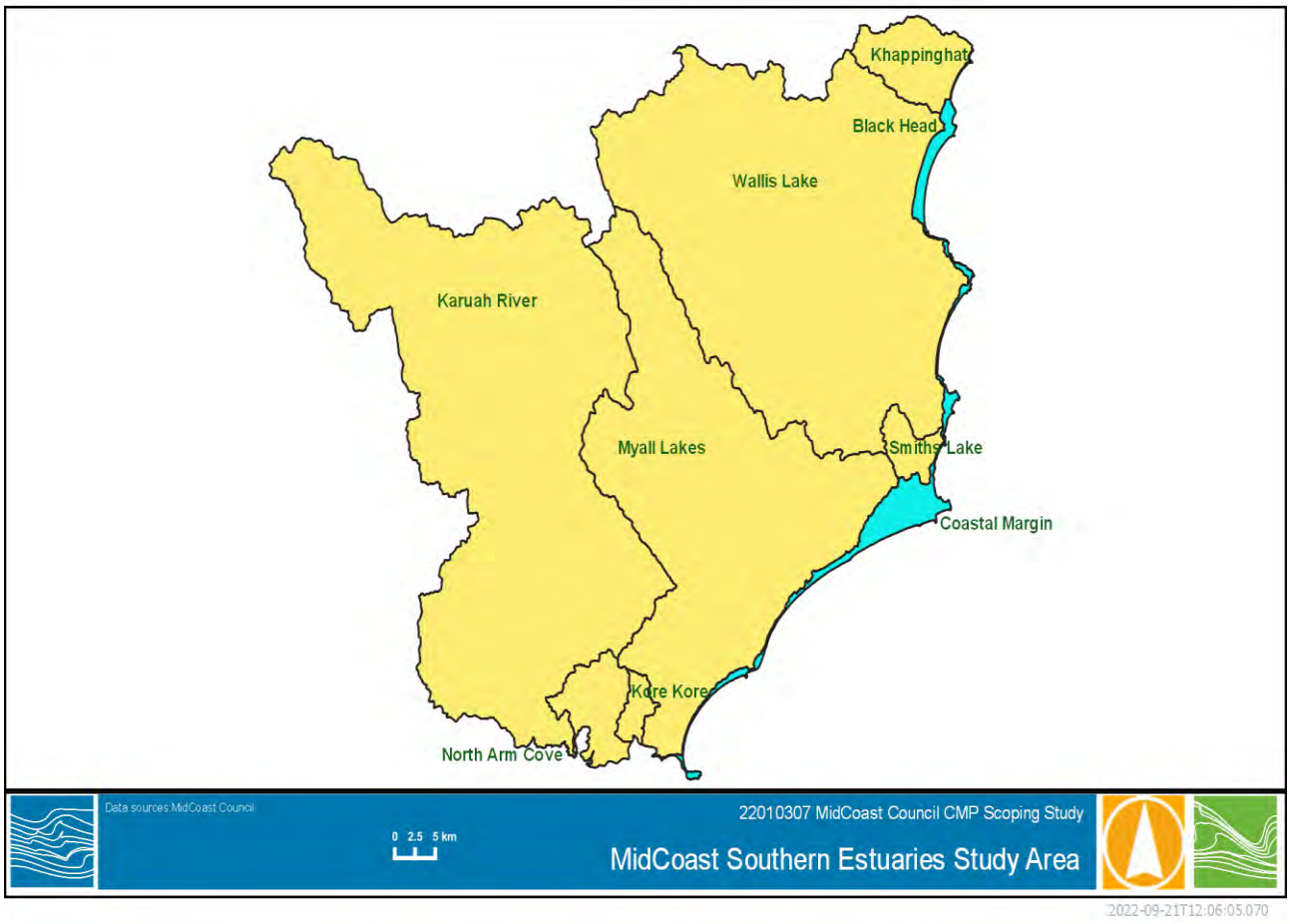

Figure 2-1 MidCoast Southern Estuaries Study Area

2.2 Considerations for the CMP Study Area

The spatial extent or scale of the CMP study area is an important consideration for guiding governance and delivery of the subsequent CMP stages. The geographical distribution of CMPs within or across a study area is based on consideration of a number of environmental, social and governance issues. Under the CM Act, CMPs are required to take a "systems" approach to coastal management. This means that the study area for the CMP needs to recognise that important physical and ecological systems extend across the catchment, coastline, estuaries and foreshore of the MidCoast southern estuaries – including water quality, ecological processes, hydrological and oceanographic processes, coastal and catchment flooding, development pressures and local and regional planning initiatives. Consequently, the study area for a CMP needs to be large enough to adequately address issues that exist on a system wide scale. However, the study area should not be so large that it lacks the required granularity and cannot adequately identify and address smaller, localised issues. The determination of the spatial scale of a CMP should aim to balance these considerations.

The advantages and disadvantages of the various spatial scales for CMP implementation are discussed below. Based on that analysis, it is recommended that a single CMP be prepared that encompasses all of the MidCoast southern estuaries and their contributing catchments.

2.2.1 A Series of Estuary Based CMPs

This approach would involve the development of estuary based CMPs and would likely involve the development of three to four programs covering (respectively) the Wallis Lakes System, Smiths Lake, the Myall Lakes system and the northern foreshore of Port Stephens including the Karuah River up to the tidal limit (or

a combination of the last two as one estuary system). This has been the historical approach to the management of these waterbodies. The rationale for such an approach is that it allows smaller scale local issues to be addressed, whilst maintaining the scale required to address larger issues affecting the estuaries.

However, an estuary scale approach would also be hamstrung by not being able to respond as efficiently to system impacts which are common across the four estuary systems (e.g., water quality). This approach would have a reduced ability to effectively address system wide issues and integrate with regional planning initiatives.

It should be noted that this approach has historically resulted in a lack of coordination amongst estuary councils, catchment councils and state agencies, as discussed in Section 6. This has resulted in significant jurisdictional ambiguity across the estuary systems, and the status quo approach may lack the scope to address these governance issues. Therefore, this approach is not recommended for an efficient CMP.

2.2.2 A Single CMP

A potential pathway for the CMP delivery is to group the four estuaries and deliver a single program that covers all of them.

From a governance perspective, a single CMP would more efficiently improve coordination and collaboration across the multitude of stakeholders with managerial responsibilities across the coastal zone and catchment. This approach would provide an integrated and clearly defined governance structure that can reduce jurisdictional ambiguity across these organisations.

Furthermore, there may be significant cost savings associated with this approach, compared to developing multiple CMPs. A single CMP would be able to harness cost advantages associated with economies of scale during Stages 2 to 4, and avoid costs associated with duplication of studies and plans across the various estuaries. From a funding perspective, the CMP could provide a greater platform for attracting government funds to address larger (multiple catchment scale) issues and threats – and can reduce likelihood of the vision and scope of a CMP being limited by an individual CMP's budget constraints.

A potential constraint could be that the geographic scale of the CMP (which is very large) may result in a loss of detail and granularity at a local level when identifying key issues and management actions. In order to ensure that a MidCoast southern estuaries CMP remains effective at a local level, the CMP could be structured to support the addressing of local scale issues. One approach could be to implement a multi-tiered structure for the CMP whereby the overarching CMP could establish shared goals and objectives, with a secondary tier of estuary scale sub-plans developed to address smaller scale local issues. The resulting CMP structure could be:

- *MidCoast Southern Estuaries CMP:* The overarching CMP can establish the shared goals, objectives and governance structure for the CMP. The CMP could establish the roles and responsibilities, and a series of actions to address system-wide issues and threats.
- *System / Estuary Scale Sub-Programs:* Within the overarching CMP, a series of system/estuary scale sub-plans could be developed that implement the overarching system-wide goals and direction, whilst achieving the required detail and granularity to address local issues.

Although there are some potential constraints identified with this approach, discussions with Council and DPE during development of this scoping study demonstrated in-principle support for a single CMP.

2.3 Overview of the Estuaries

2.3.1 Khappinghat Creek

Khappinghat Creek is situated near the township of Wallabi Point (See Figure 2-2). It is classed as an estuary lagoon and is a naturally opening and closing estuarine system (an ICOLL). It has a catchment area of 90.7 km^2 with an estuary area of 1.2 km^2. The total estuary volume is 880 ML with and average depth of less than 1 m. All the Khappinghat Creek estuary, most of the shores, and 57% of lands within 1 km are already protected within Khappinghat Nature Reserve. The reserve was created in August 1993 and covers an area of 1494 ha. Approximately 70% of the catchment land remains forested and other land which includes urban areas and rural residential–grazing areas each make up about 14%. Khappinghat Creek is surrounded by Khappinghat Nature Reserve and meets the sea within Saltwater National Park. Khappinghat Creeks had less than 10% acid sulphate soils within 1 km and there are few neighbouring built-up areas or disturbed acid sulphate soils in its catchment. The Australian River and Catchment Disturbance indicators show little disturbance to flow or catchment. Extensive areas of subtidal reef are also mapped off the coast Khappinghat Creek (D.A. Breen, 2004).

Figure 2-2 Khappinghat Creek (Source: NSW Gov)

Khappinghat Creek contains small areas of seagrass and extensive areas of sand, mud flats and rocky shores. The creek system includes large areas of Casuarina, Melaleuca and Juncus wetlands protected under the CMP SEPP. Its entrance at Saltwater Beach support a rich fabric of undisturbed habitats and hold spiritual significance to local First Nations people, with several sites related to the Dreamtime located here (D.A. Breen, 2004).

The shallow and clear waters of the creek is popular among with flat-water canoeists and kayakers all year round. This creek is also famous among birdwatches to spot white-breasted sea eagles, ospreys and brehminy kites (D.A. Breen, 2004).

2.3.2 Black Head Lagoon

Black Head Lagoon is located between the Red Head beach and Pebbly Beach. It is classed as a creek, with an entrance intermittently open to the sea at the Black Head Beach with an approximate catchment area two square kilometres and estuary area of ten meters. It is very shallow with an average depth of 0.2 meters.

Figure 2-3 Black Head Lagoon (Source: NSW Gov)

The catchment of Black Head Lagoon is highly urbanized and has two main towns of Black Head and Hallidays Point. The catchment has amenities such as the Surf life club, Big4 Holiday Park, Bowling Club, the Black

Head rock pool and offers retirement living. An area of bushland remains adjacent to the estuary, but most bushland has been cleared.

The water quality in the lagoon is poorest among all the estuaries within the study area. There is large number of algae, and the clarity of the water is often poor mainly due to the overflows from the urbanised areas around its catchment. Occasional incidents of sewage overflows have been reported making it temporarily unfit for human activities.

2.3.3 The Wallis Lake System

Covering over 1,400 km^2 the Wallis Lake system (See Figure 2-4) comprises the biggest catchment within the study area and houses unique and varied ecosystems that support agriculture, commercial and recreational fishing, aquaculture and tourism industry – see Figure 2-9.

The dominant geographic features include coastal plains, inland ridges and valleys. The catchment is primarily made up of seven sub-catchments

- Wallamba River
- Lower Wallamba River
- Wang Wauk River
- Minimbah Sandbed
- Coolongolook River
- Wallingat River and
- Wallis Lake Body

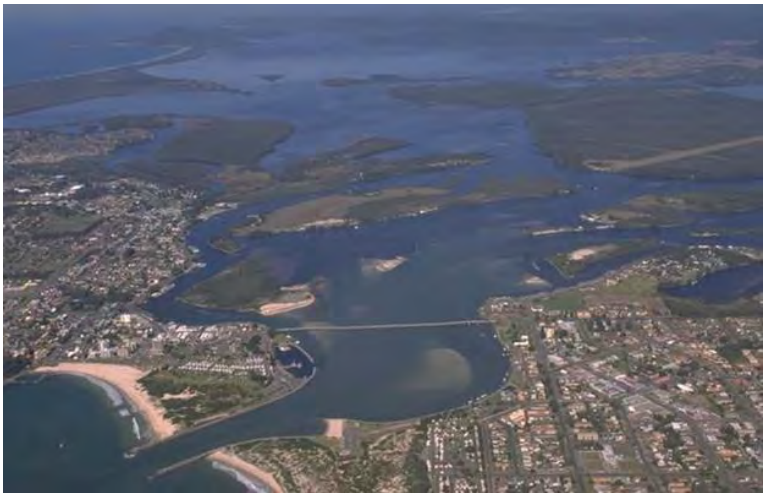

Figure 2-4 Wallis Lakes (source: NSW Gov)

The Wallamba River & Lower Wallamba River catchment totals to about 42,957 ha and is highly modified and cleared for agricultural purposes. The upper Wallamba River is mostly freshwater, while the lower river has saline tidal influence. The sub-catchments of Wang Wauk and Coolongolook Rivers (38,964 ha) are the most modified of all sub catchments with high proportions of agricultural land usage.

The Wallingat River catchment (17,313 ha) remains the least modified. Nearly 72% of the land in the sub catchment is either private native forest, state forest or conservation estate. The other sub catchment comprises of the Wallis Lake body and its foreshores (17,779 ha), along with adjacent townships of Forster and Tuncurry.

Wallis Lake is large sub-tropical, trained, permanently open estuary that flows into the sea between the township of Forster and Tuncurry. The water body is just over 85 km² and has a relatively shallow depth averaging 1.8 m. Being permanently open there is considerable exchange between the ocean and the estuary.

Average rainfall ranges between 1,000-1,500 mm and its freshwater inputs comes from the Wallamba, Wallingat, Coolongolook, and Wang Wauk Rivers (Great Lakes Council, 2014).

The major urban settlements in the Wallis catchments are Forster/Tuncurry Green Point, Coomba Park, Coolongolook and Nabiac. Over the recent year there has been a significant expansion of the urbanized areas in Forster/ Tuncurry. Pollutants from the urban catchments of Forster enter the Pipers Bay region of Wallis Lake and can influence the main body of the lake. Chlorophyll-a concentrations in Pipers Creek are the highest measured anywhere in the lake system. Thus, these urban centres are the biggest influence on water quality and ecosystem health of the lake.

2.3.4 Smiths Lake

Smiths Lake is a large coastal lake, located on the lower-north coast of NSW between Wallis and the Myall Lake – see Figure 2-9. The lake is classified as an intermittently closed and open lake or lagoon (ICOLL).

Figure 2-5 Smiths Lake (Source: MidCoast Council)

The lake's catchment is approximately 34 km^2, with surface waters of about 11 km and has a maximum fetch of around 3 km. There are no major rivers that flow into the lake, and the tributaries feeding into the lake are Wamwarra Creek, Tarbuck Creek and Bramble's Creek. The lake has three islands within its main water body - Big Island, Little Island and Bull Island. The bordering catchment is largely undeveloped and has only small townships of Smiths Lake and Tarbuck Bay on the northern shore and Bungwahl on the west. The northern and southern sections of the lake are surrounded by open forest, forested wetlands and open freshwater wetlands. Smiths Lake, and its creeks and tributaries to the tidal limit are part of the Port Stephens-Great Lakes Marine Park.

The estuary is a "barrier lagoon system" with a coastal sand dune barrier on the eastern foreshore impounding the lake waters within a drowned valley (See Figure 2-5). The entrance region forms a sand barrier between main channel and Symes Bay. The ocean entrance or the opening of the estuary is across a sandy beach called Sandbar Beach. The lake's entrance is mechanically opened by Council on an as-needed basis for flood mitigation purposes following established protocols.

Smiths Lake catchment soils are generally of low fertility: colluvial and aeolian soil landscapes, dominating the inland slopes and coastal dunes, respectively. The foreshore areas occur on high slope (>20%). The highest point in the catchment is 150 m AHD at Caves Hill, immediately west of the lake. The northern part of the catchment rises to about 100 m AHD. The catchment's steep topography and infertile soils limits agricultural activity allowing about 23 km^2 of the catchment land to be either forested land under private ownership or with state forest and National Parks.

The main urbanised area is Smiths Lake village, which includes a mixture of residential and holiday homes. Several residential properties are also located at Tarbuck Bay and Bungwahl. There are two non-operational quarries, a golf course, Sandbar Caravan Park and several tourist accommodations, located in the Smiths Lake village area.

2.3.5 Myall Lakes System

The Myall Lakes system is a coastal barrier lake system comprising four linearly connected brackish to freshwater waterways, with a total catchment area of 780 km^2. The waterbody itself is also significant comprising 102 km^2, 11.2% of the total catchment area (See Figure 2-6). The four basins include the Myall Lake, Boolambayte Lake, Two Mile Lake and Bombah Broadwater. The average depth of the lake is 2.7 m with the deepest point as about 13 m within the connecting channels. The Myall Lakes catchment is divided into six sub catchments.

- Upper Myall River;
- Lower Myall River;

- Crawford River;
- Bombah Broadwater;
- Boolambayte Creek; and
- the Myall Lake catchment area (Great Lakes Council, 2009).

Figure 2-6 Myall Lakes. (Source: NSW Gov)

In 1999, Myall Lakes were designated as a Wetland of International Importance under the Ramsar Convention and are protected by conservation reserves managed by the NSW Government. The area consists of Myall Lakes National Park, Little Broughton Island Nature Reserve, Corrie Island Nature Reserve, and part of Gir-umbit National Park. The estuarine and brackish waters and the beaches and intertidal areas in the site are within Port Stephens – Great Lakes Marine Park.

Much of Myall Lakes and surrounding catchment have experienced relatively little disturbance. The catchment is largely forests and protected vegetation in conservation areas. There are a few small residences in the northern catchment, a small amount of urban land in the townships of Bulahdelah and the well-known tourist destinations of Tea Gardens-Hawks Nest.

2.3.6 Northern Foreshore of Port Stephens and the Karuah River

Port Stephens and the Karuah River collectively makeup 300 km^2 of waterways, which makes them one of the largest estuarine waterways in NSW. The study area covers the northern foreshore of Inner Port Stephens, from Yallimbah Creek to Pindimar (including Tea Gardens and Hawks Nest) and including North Arm Cove and The Karuah River up to the limit of tidal influence, one kilometre south of the village of Booral.

Port Stephens–Great Lakes Marine Park extends from Cape Hawke near Forster south to Birubi Beach at the northern end of Stockton Beach. It includes all of Port Stephens, the Karuah River, the Myall River, and their creeks and tributaries to the tidal limit. Areas within Bundabah, Pindimar, Fame Cove, Corrie and Cut Feet Island within the study area are marked as sanctuary zones of the Marine Park.

Port Stephens is one of the fastest growing tourist destinations in NSW and a principal tourist its sandy beaches and large scenic estuarine waterways. Although most urban areas in Port Stephens have grown over the recent years from foreshore villages, the population of the northern foreshore is much lower than the southern shore. Nonetheless, the signs of increasing pressure from urban development and population growth are clearly apparent in the area (Umwelt, 2000) .

The hinterland and the shoreline on the northern foreshore include areas that are steep and rocky and almost all of the shoreline is under private ownership with the exception of small area of the National Park in Fame Cove.

The Pindimar area within the estuary has sandy and mangrove lined shoreline (See Figure 2-7). The adjacent land to the shoreline is low-lying, and flood prone land. This area is impacted by erosion of the sandy beaches and has mobile sediments in the nearshore, which has been a cause of concerns for the local community (Umwelt, 2000).

Located on the northern shore of Port Stephens, the North Arm Cove (See Figure 2-8) village has approximately 300 residents and is expanding.. Large areas of the Cove are used for oyster culture and has over 100 hectares of derelict oyster leases.

Figure 2-7 Pindimar Area (Source: NSW Gov)

The Karuah River extends all the way from Barrington Tops and discharges into the Port Stephen estuary. The Karuah River catchment is approximately 1,500 km^2. The tidal limit of the is situated 4 km upstream of Allworth and 24 km upstream of Karuah. The Branch River (is an significant sub-catchment of the Karuah catchment) which converges with the Karuah River in the mid-section of the estuary, which supports a vast area of mangrove forest. The major tributaries of the Karuah River include Wards River, Mammy Johnsons River and Mill Creek in the north eastern reaches; Telegherry River and upper Karuah River in the north-west headwaters (Great Lakes Council, 2015)

Figure 2-8 North Arm Cove Estuary (Source: Northarmcove.nsw.au)

The catchment is mostly rural and lightly populated, most of which is located at the river mouth. Intensive chicken production is a major agricultural land use and although farmers generally maintain good agricultural management practices, organics waste remains an issue (Umwelt, 2000).

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Figure 2-9 Locality Map – Wallis and Smiths Lake

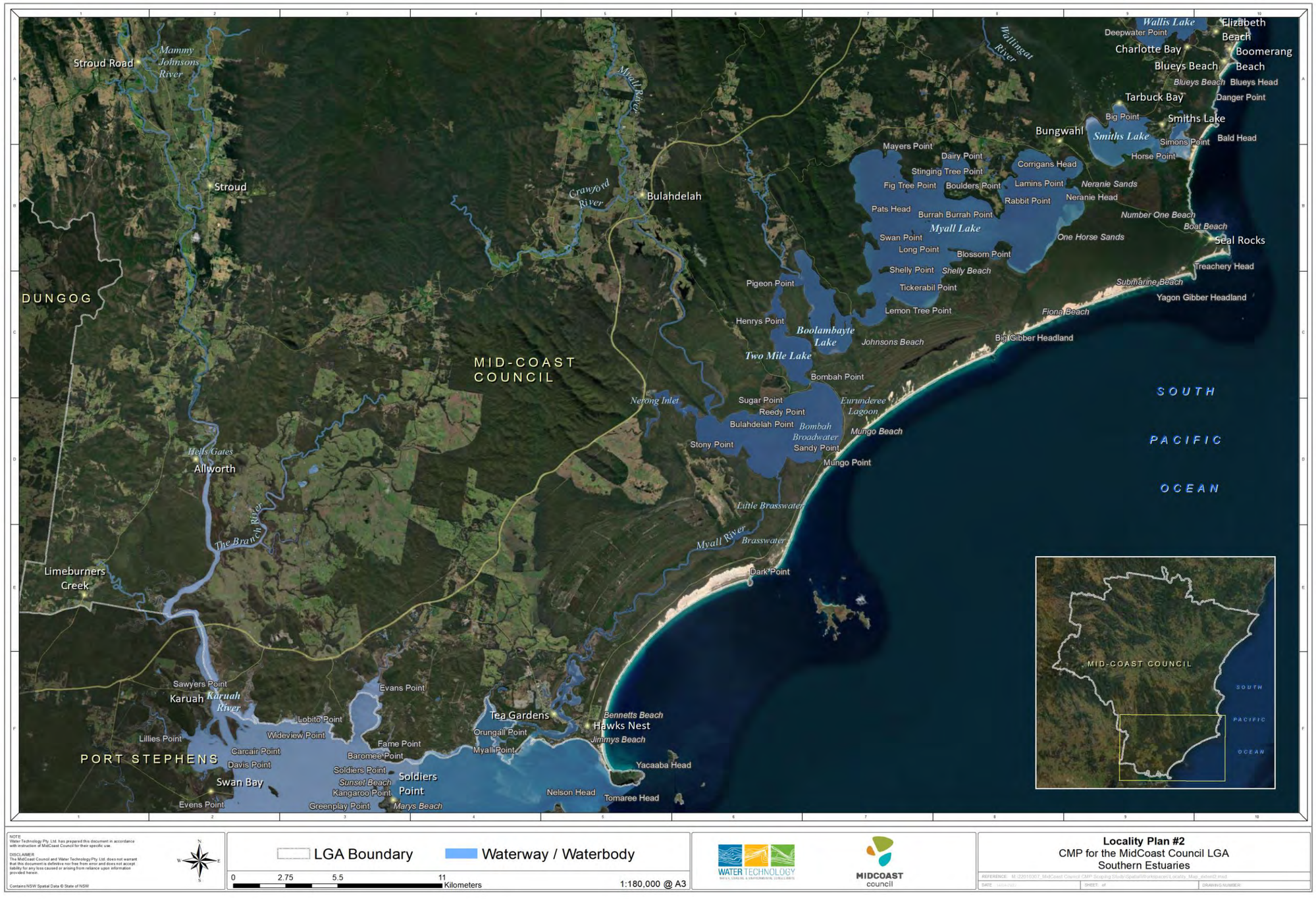

Figure 2-10 Locality Map – Myall Lakes and Port Stephens

2.4 Coastal Management Areas

The coastal zone that comprises the CMP study area is made up of the four NSW coastal management areas (CMAs), as outlined in the CM SEPP 2018. A brief description and definition of each of these CMAs is provided below.

2.4.1 Coastal Environment Area

The CM Act defines the coastal environment area as land containing coastal features such as the coastal waters of the states, estuaries, coastal lakes, coastal lagoons, and land adjoining those features including headlands and rock platforms. Beaches, dunes and foreshores are included in this area. Within estuaries, the coastal environment area extends upstream to the extent of tidal influence.

The area of land adjacent to the open coast, estuary or coastal lake/lagoon is also included in the coastal environment area. This is to ensure nearby development considers potential impacts on the coastal environment. The CM SEPP mapping for the coastal environment area therefore includes the following buffers around these coastal features:

- *For estuaries and coastal lakes:* a 500 m landwards buffer
- *For beaches, dunes, headlands, rock platforms and foreshore:* a 250 m landwards buffer.

The coastal environment area mapping provided in the CM SEPP.

The management objectives for the Coastal Environment Area provided in the CM Act are:

- to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity;
- to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change;
- to maintain and improve water quality and estuary health;
- to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons;
- to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place; and
- to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms.

2.4.2 Coastal Use Area

The CM Act defines the coastal use are as being land adjacent to coastal waters, estuaries, coastal lakes and lagoons where development is or may be carried out (at present or in the future), and impacts of development on the scenic and cultural values and use and enjoyment of the beaches, foreshores, dunes, headlands, rock platforms, estuaries, lakes and the ocean need to be considered.

In regional NSW, the coastal use area is defined as the 500 m landward extent from the open ocean boundary of LGAs, and a 250 m landward extent from the boundaries of estuaries.

The coastal use area mapping provided in the CM SEPP is depicted in Figure 2-11 and Figure 2-12 .

The management objectives for this area within the CM Act are to accommodate both urbanised and natural stretches of coastline and to protect and enhance the scenic, social and cultural values of the coast by ensuring that:

- the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast;
- adverse impacts on cultural and built environment heritage are avoided or mitigated;
- urban design, including water sensitive urban design, is supported and incorporated into development activities;
- adequate public open space is provided, including for recreational activities and associated infrastructure; and
- the use of the surf zone is considered.

2.4.3 Coastal Wetlands and Littoral Rainforests Area

The CM Act defines the coastal wetlands and littoral rainforests area as the land which displays the hydrological and floristic characteristics of coastal wetlands or littoral rainforests, as well as a surrounding proximity area to manage impacts of adjacent development.

Coastal wetlands mapped in NSW for the development of the CM SEPP include those that are dominated by the following vegetation types: mangroves, saltmarshes, melaleuca forests, casuarina forests, sedgelands, brackish and freshwater swamps, and wet meadows.

Littoral Rainforests are defined by their dominant vegetation which include riberry, broad leaved lilly pilly, tuckeroo, brush box, yellow tulip, baurela, red olive plum, plum pine, cabbage palm and various figs.

The mapping for these areas includes a 100-metre proximity area, applying to all land zones around coastal wetlands and littoral rainforests.

The coastal wetlands and littoral rainforests area mapping provided in the CM SEPP is depicted in Figure 2-13 and Figure 2-14

The CM Act specifies that the management objectives for this area are:

- to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity;
- to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests;
- to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration;
- to support the social and cultural values of coastal wetlands and littoral rainforest; and
- to promote the objectives of State policies and programs for wetlands or littoral rainforest management.

2.4.4 Coastal Vulnerability Area

The coastal vulnerability area (CVA) is defined in the Act as land which is subject to coastal hazards. The area focusses on identifying land subject to current and future coastal hazards, and to ensure land use management and development undertaken in these areas recognise coastal risk and is subsequently appropriate. The Act provides for the management of seven coastal hazards:

- Beach erosion;
- Shoreline recession;
- Coastal lake or watercourse entrance instability;
- Coastal inundation;
- Tidal inundation (often referred to as “sunny-day flooding”);
- Coastal cliff or slope instability; and
- Erosion and inundation of foreshores caused by tidal water and waves, including the interaction of those waters with catchment floodwaters.

The CM Act specifies that the management objectives for this area are to:

- ensure public safety and prevent risk to human life;
- mitigate current and future risks from coastal hazards, taking into account the effects of coastal processes and climate change;
- maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place;
- maintain public access, amenity and use of beaches and foreshores;
- encourage land use that reduces exposure to risks from coastal hazards, including through siting, design, construction and operational decisions;
- adopt coastal management strategies that reduce exposure to coastal hazards, in the first instance by restoring and enhancing natural defences such as coastal dunes, vegetation and wetlands; and, if that is not sufficient, by taking other action to:
  - avoid significant degradation of biological diversity and ecosystem integrity;
  - avoid significant degradation or disruption of ecological, biophysical, geological and geomorphological coastal processes;
  - avoid significant degradation of or disruption to beach and foreshore amenity and social and cultural values;
  - avoid adverse impacts on adjoining land, resources or assets; and
  - provide for the restoration of the beach or adjacent land if any increased erosion is caused by actions to reduce exposure to coastal hazards.
- prioritise actions that support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency; and
- improve the resilience of coastal development and communities by improving adaptive capacity and reducing reliance on emergency responses.

At the time of preparing this Scoping Study, there was no map published under the Local Environmental Plan (LEP) to identify the CVA across the study area. Therefore, a planning proposal will be required to prepare a LEP which declares a map (based on the outcomes of the CMP) to be the CVA for the study area.

It is important to note that the CMP hazard mapping identifies a range of risk exposures (current and future) for several different hazards (listed above). However, the CVA mapping as part of the CM SEPP selects one of those lines (or more likely a separate line derived from several of those lines), to determine where the CVA controls will apply.

Coastal and Catchment Inundation

There have been a number of flood studies and floodplain risk management plans undertaken across the study area of the last 15 to 20 years, and these are summarised below:

- *The Wallis Lake Floodplain Risk Management Study* (WMAWater, 2014): This study was undertaken to update the original Forster/Tuncurry Flood Study, which was completed in 1989. The study utilised more contemporary physical data, and a more rigorous hydraulic modelling approach. The study investigated the joint occurrence of coastal and catchment flooding for a range of Annual Recurrence Interval (ARI) ARIs from the 5 year ARI event to a 500 year ARI. An envelope approach was adopted which assumed the maximum of an ocean dominated event and a runoff dominated event. The study considered future climate change scenarios of increased rainfall intensity and sea level rise scenarios of +0.5m, and +0.9m.
- *Smiths Lake Flood Study* (Webb, McKeown & Associates, 2008): This study utilised hydrologic/hydraulic models to determine design flood behaviour including the calculation of design flood levels. Modelling was undertaken for design events from the 2y ARI to the 500y ARI and Probable Maximum Flood (PMF).
- *Lower Myall River and Myall Lakes Flood Study* (BMT WBM, 2015): This study utilised state-of-the-art models and additional data sets to assess the vulnerability of the Lower Myall River and Myall Lakes to both coastal and catchment-based inundation. A suite of design event scenarios were defined that were considered suitable for future floodplain management planning – ranging from the 5 year ARI event to a 500 year ARI. The study considered future climate change scenarios of increased rainfall intensity and sea level rise scenarios of +0.5m, and +0.9m.
- *Karuah River and Stroud Flood Study Update* (Advisian, 2021): Utilised hydraulic modelling to assess combined coastal and catchment inundation across the Karuah River catchment. The study applied design oceanic water levels for Port Stephens at its downstream boundary, and therefore provides detailed mapping of coastal inundation at Karuah.
- *Port Stephens Design Flood Levels - Climate Change Review* (WMAwater, 2010): This study assessed coastal inundation across the foreshores of the Port Stephens Estuary – including the effects of wave run-up. The study covers events of a range of ARI's and includes future sea level rise scenarios of +0.4m, and +0.9m. Council has undertaken a floodplain risk management study and plan for the northern foreshores of Port Stephens, which includes North Arm Cove, Bundabah, Carrington and Pindimar (BMT WBM, 2020a).

Tidal Inundation

The NSW Estuary Tidal Inundation Exposure Assessment was undertaken by DPE (then NSW OEH) in 2018 (OEH, 2018g), along with associated mapping of tidal inundation extents. This undertaking represents a state-wide assessment of the impact of inundation in estuaries associated with projected sea level rise (SLR) on the NSW coast. The aim of the study was to refine estimates of the extent of current exposure of properties and infrastructure to potential SLR to help assess the need for, and prioritisation of, adaptation planning and action. As part of the study mapping was undertaken of the High High-Water Solstice Springs (HHWSS) tidal planes for each of the estuaries along the NSW coastline. Mapping was also undertaken for three SLR scenarios: 0.5 m, 1 m and 1.5 m. These were selected to be representative of a range of scenarios relevant to infrastructure design and land-use planning (OEH, 2018g).

After completion of the mapping, an exposure assessment was undertaken whereby the inundation mapping was cross-referenced with the Geocoded Urban and Rural Addressing Service (GURAS) assets database to identify existing development at risk from inundation for each scenario.

The study identified the total number of properties and length of road affected by inundation under the various sea level rise scenarios, and this data is presented in Table 2 2 and Table 2 3 respectively. Overall, the level of exposure is expected to be very high over long term planning horizons, particularly around Wallis Lake, and the Lower Myall Lake system.

Table 2-2 Number (and %) of Catchment Properties Affected by Tidal Inundation, as Per OEH (2018)

Estuary System	Total Properties in Catchment	SLR=0m	SLR=0.5m	SLR=1.0m	SLR=1.50m
Khappinghat Creek	376	6 (2%)	8 (2%)	8 (2%)	9 (2%)
Black Head Lagoon	711	0 (0%)	0 (0%)	5 (1%)	6 (1%)
Wallis Lake	13,340	282 (2%)	617 (5%)	1,130 (8%)	1,777 (13%)
Smiths Lake	1,237	12 (1%)	27 (2%)	49 (4%)	66 (5%)
Myall Lakes	4,764	27 (1%)	269 (6%)	586 (12%)	1,180 (25%)
Karuah River	967	24 (2%)	63 (7%)	74 (8%)	82 (8%)
Port Stephens**	23,166	175 (1%)	850 (4%)	1,389 (6%)	1,836 (8%)

Table 2-3 Length (in KM) and % of Road Affected by Tidal Inundation, as Per OEH (2018)

Estuary System	Total Length of Road in Catchment	SLR=0m	SLR=0.5m	SLR=1.0m	SLR=1.50m
Khappinghat Creek	65	1.2 (2%)	2.3 (4%)	3.6 (5%)	5.7 (9%)
Black Head Lagoon	16	1.9 (3%)	3.8 (7%)	7.0 (12%)	8.9 (15%)
Wallis Lake	870	5.4 (1%)	20.7 (2%)	53.6 (6%)	84.2 (10%)
Smiths Lake	57	1.8 (3%)	3.8 (7%)	6.9 (12%)	8.9 (15%)
Myall Lakes	645	2.9 (0%)	13.4 (2%)	33.1 (5%)	59.8 (9%)
Karuah River	389	0.3 (0%)	2.6 (1%)	4.8 (1%)	6.1 (2%)
Port Stephens**	697	1.7 (0%)	13.0 (2%)	31.5 (5%)	46.8 (7%)

** *it should be noted that the values given for Port Stephens represent the entire estuary foreshore, including the southern foreshore, located within the Port Stephens LGA*.

When considering this data, it should be noted that the DPE exposure assessment is limited to a broadscale assessment of the tidal inundation risk to property and infrastructure – and should not be used to assess risk to individual properties and assets. DPE has indicated that where individual estuaries are identified to contain a high level of inundation risk, that this inundation mapping does not replace the need to undertake more detailed flood or inundation studies (OEH, 2018g).

Nonetheless, the study provides a high-level indication of exposure to tidal inundation, and this has been used to inform the First-Pass-Risk-Assessment in Section 8 and the Knowledge Gap Analysis in Section 9.

Coastal Erosion and Estuary Entrance Instability

- *Great Lakes Coastal Hazard Study* (SMEC, 2013) assessed a range of coastal hazards across the former Great Lakes LGA. This includes coastal erosion, long term shoreline recession, coastal inundation, and estuary entrance instability. Whilst it mostly focusses on the open coastline, the relevance of that study to this CMP is that it covers the instability of the estuary entrance at Smiths Lake and Sandbar Beach. Notably, the study area for this assessment extends into the Port Stephens estuary only so far as Jimmys Beach- and therefore does not include other area of the Port Stephens foreshore.
- *Lower Pindimar, Pindimar, Upper Pindimar and Bundabah Foreshore Erosion Study* (BMT WBM , 2010): This study investigated foreshore erosion issues along these shorelines, including: The extent of erosion

in residential areas, including both private and public lands; The potential causes of any observed erosion (e.g. waves, tidal currents, boat wake, stormwater discharges, mangrove dieback); and, protection options to manage identified erosion). A suite of strategies to enhance and improve foreshore protection and habitats in the study area is detailed in the plan – along with a suite of sub-actions to implement these strategies. These strategies should be reviewed in Stage 3 in order to determine if they can be included in the eventual CMP.

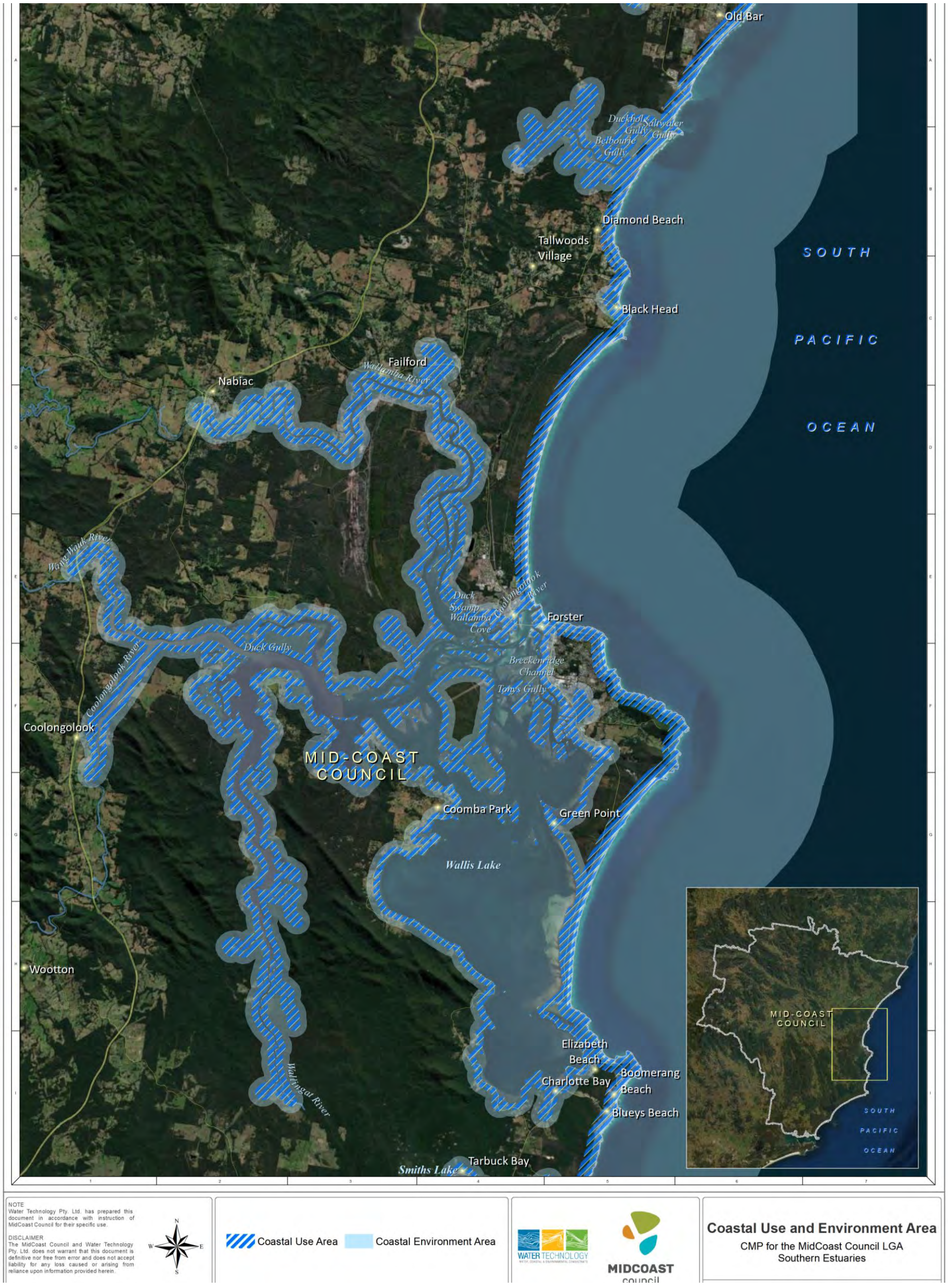

Figure 2-11 Coastal Use Area and Coastal Environment Area - Wallis and Smiths Lake

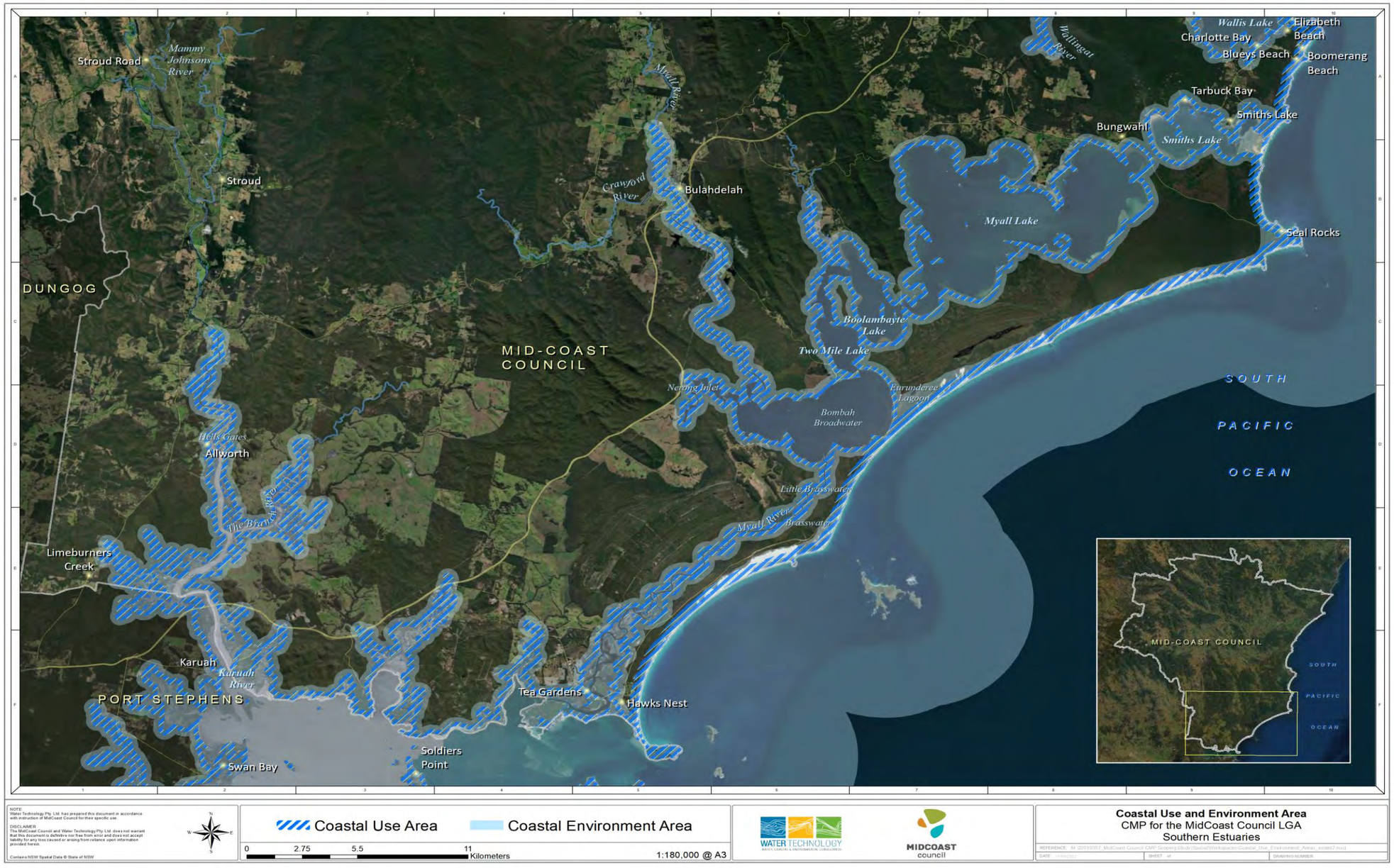

Figure 2-12 Coastal Use Area and Coastal Environment Area – Myall Lakes and Port Stephen

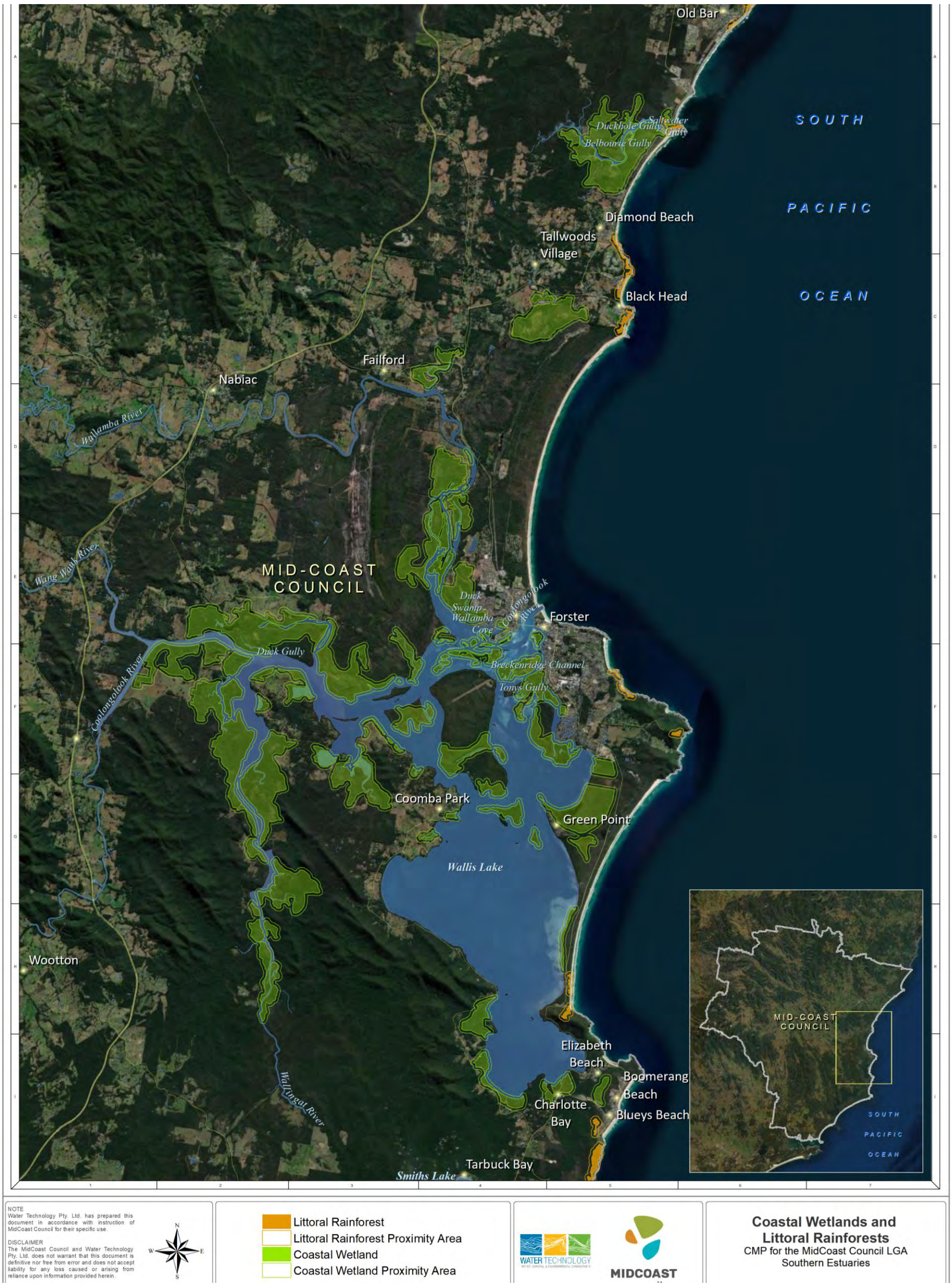

Figure 2-13 Coastal Wetlands and Littoral Rainforests - Wallis and Smiths Lake

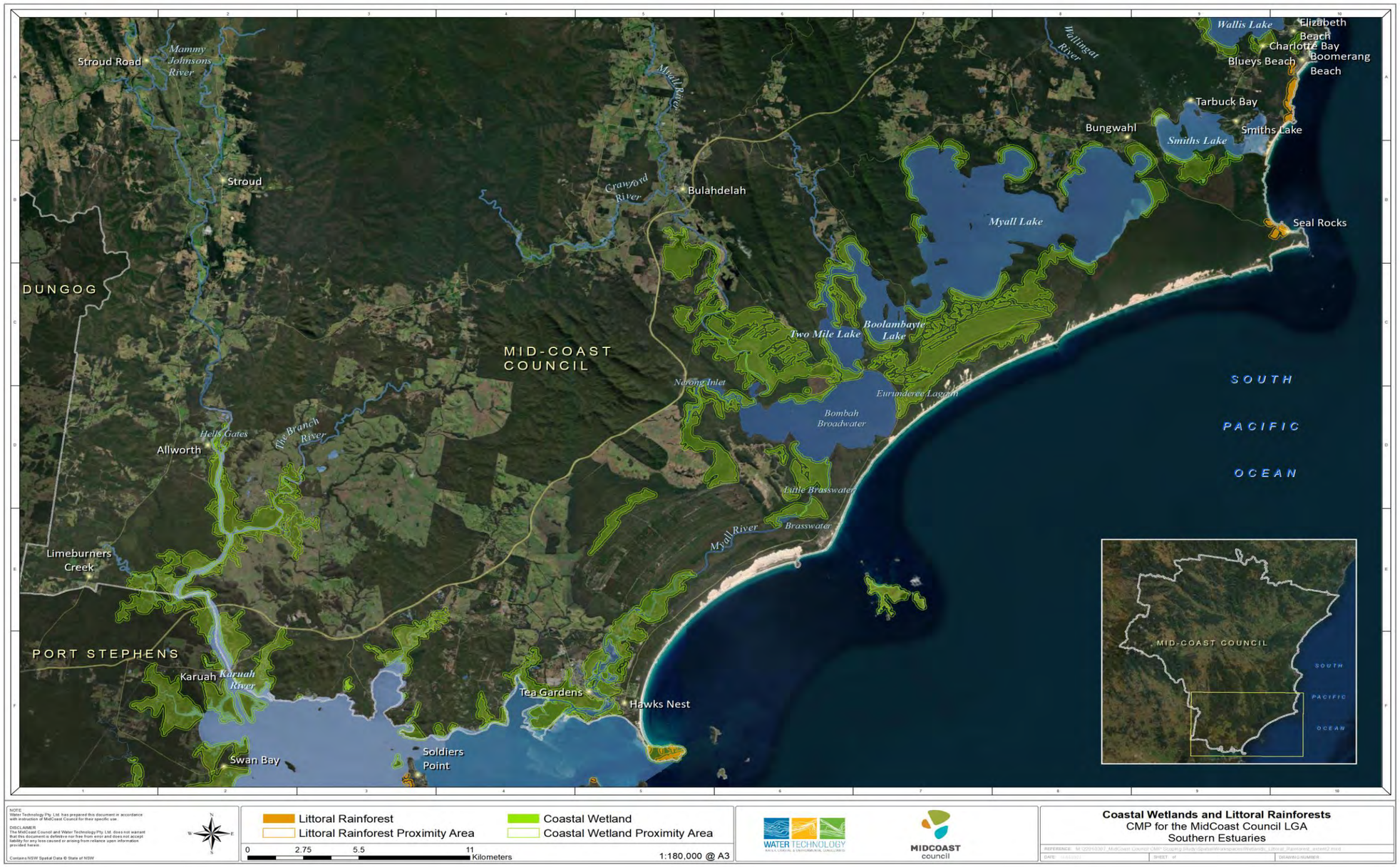

Figure 2-14 Coastal Wetlands and Littoral Rainforests – Myall Lakes and Port Stephen

3 PURPOSE, VISION AND OBJECTIVES

3.1 Purpose

The purpose of the CMP is to set the long-term strategy for the coordinated management of the MidCoast southern estuaries. The CMP seeks to achieve the objects of the CM Act through a program to identify coastal management issues, pressures, risks and opportunities – and provide a 10-year framework for the actions required to address these issues in a strategic and integrated way.

3.2 Vision

A local vision statement has been developed to help stakeholders identify with the future of the four estuaries, encourage a sense of community ownership of the actions in the CMP, and foster commitment to its preparation and implementation. The Vision Statement for this CMP has been developed in consultation with Council and is consistent with the Vision Statements prepared for the other CMPs across the study area. The Vision for the CMP is:

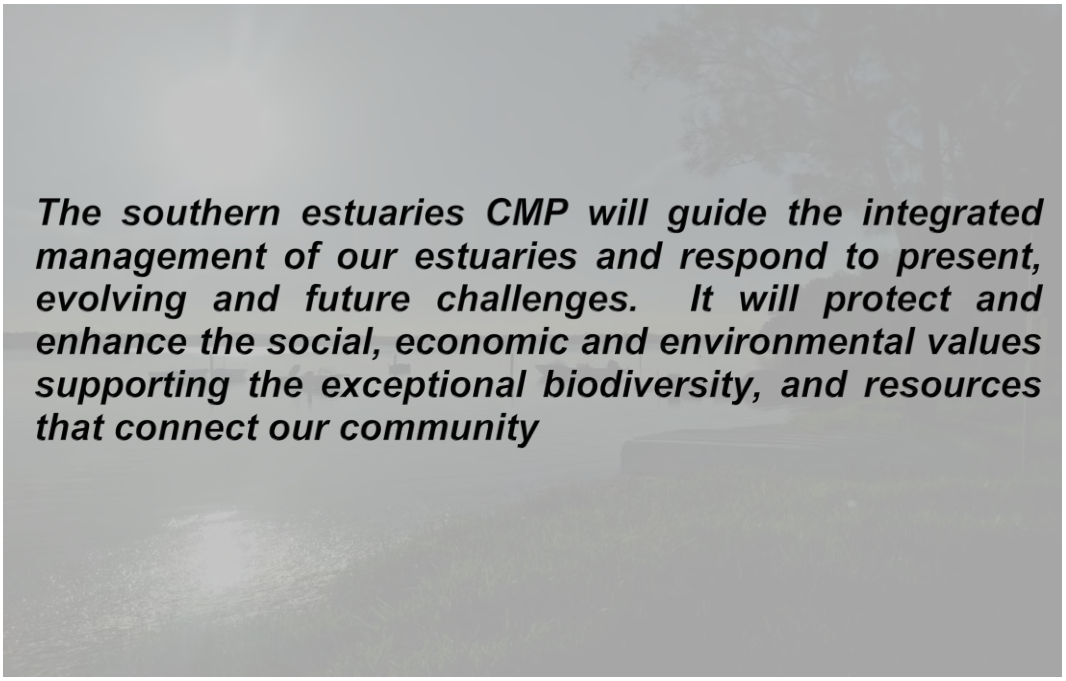

Figure 3-1 The Vision Statement

3.3 Program Logic

The CMP objectives have been assessed through a program logic methodology. Program logic is the rationale behind a program—what are understood to be the cause-and-effect relationships between program activities, outputs, intermediate outcomes and longer-term desired outcomes (NRM, Australia Government, 2009). Widely used in natural resource management, program logic presents both sequence of events and array of expected consequences, which help to guide and evaluate the program. Managing the resource outcomes may occur over longer time frames which could be 20 to 50 years longer their initial planning or investment cycles. Natural resource management outcomes should be considered within this context. The logic therefore acknowledges that to achieve and adequately report on desired outcomes there must be a focus on both the means and the ends (MidCoast Council, 2020). There are two important investment streams:

- Investment in social, institutional and economic outcomes – (means).
- Investment in biophysical outcomes – (ends).

Program logic has been used in this study in order to develop an understanding of the CMP objectives and requirements. An example of how this approach will be applied to the Southern Estuaries CMP is provided in Figure 3-2 below, consistent with the Manning River Estuary CMP. Application of this approach to the MidCoast Southern Estuaries CMP (through the eventual Stage 5 process) is also provided in the Figure 3-3.

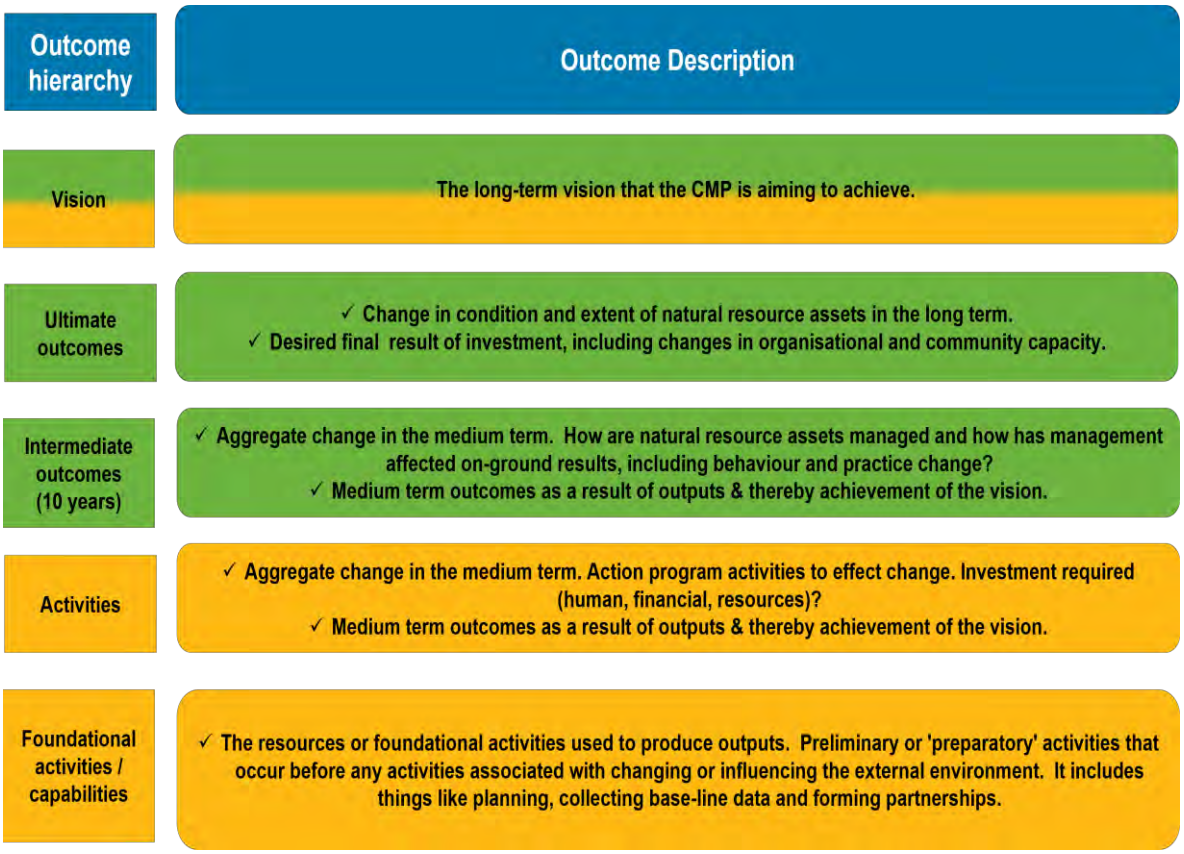

Figure 3-2 Application of Program Logic Framework to CMP Planning (Adapted from Manning River Estuary CMP for consistency)

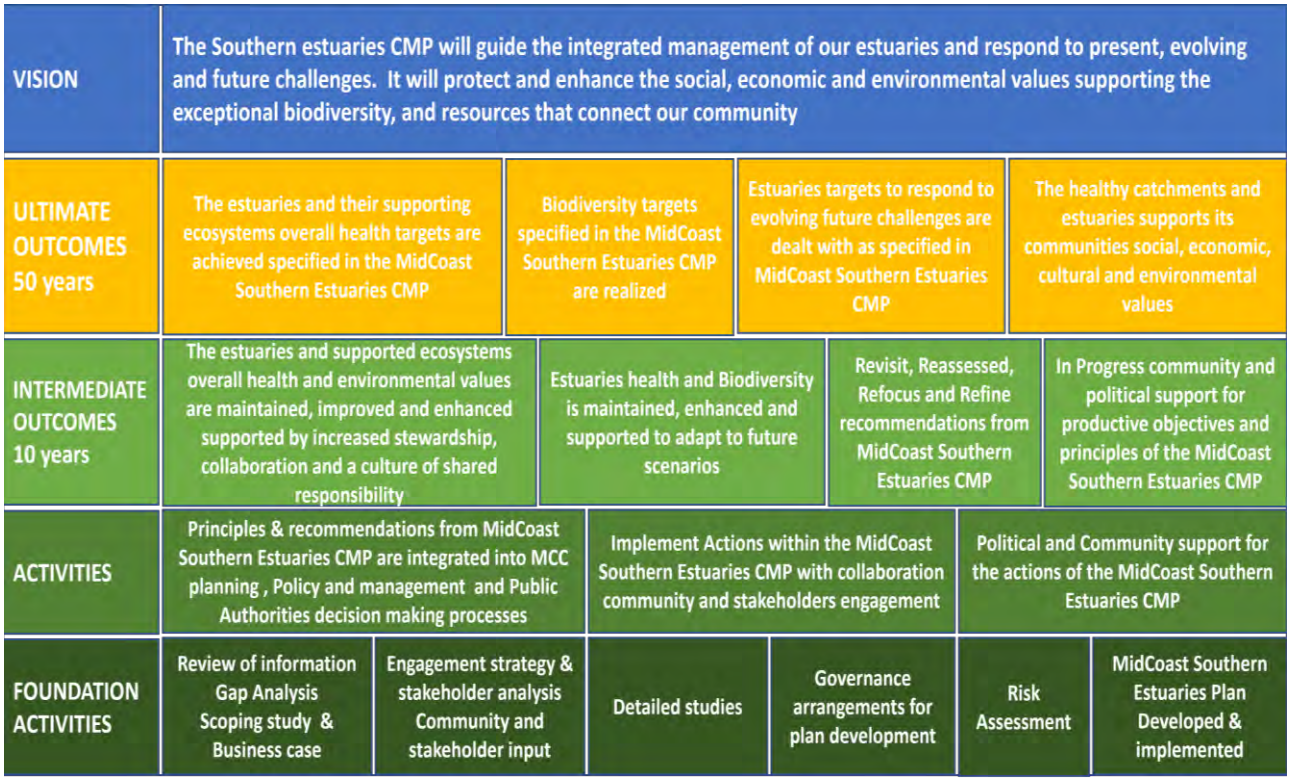

Figure 3-3 MidCoast Southern Estuaries CMP Program Logic

3.4 Objectives

A suite of objectives has been developed for the CMP, in order to ensure that the outcomes are consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the LGA. They have been developed ensuring consistency and compatibility with the objectives set forth in the following earlier works:

- *The NSW Coastal Management Act* (2016);
- The Coastal Management State Environmental Planning Policy (2018);
- The Hunter Regional Plan 2036 (DPE, 2017);
- The Hunter Local Land Services Local Strategic Plan 2021-2026;
- The objectives put forth for existing CMPs within LGA, including Manning River CMP (MidCoast Council, 2020);
- The objectives put forth for existing management plans for the four main estuaries (See Section 6.1);
- The NSW Water Quality and River Flow Objectives (NSW Government, 1999);
- The Marine Quality Objectives for NSW Ocean Waters (DEC, 2005);
- The Marine Estate Management Strategy (MEMS, 2018);
- The NSW Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions (OEH, 2017); and

- The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000).

The objectives of the CMP have been outlined in broad terms, to establish the overall strategic direction of the program. It is anticipated that these objectives will undergo further refinement in consultation with the local community during later stages of the CMP. The objectives of the CMP are:

a) to protect and enhance the integrity and resilience of the environmental values of the MidCoast southern estuaries for current and future generations;

b) to maintain and protect water quality across the system and its impacts on environmental, social and economic values - including ecological condition, recreational amenity and agricultural uses;

c) to promote community understanding, a sense of connection and stewardship of estuary values;

d) to maintain and preserve the unique scenic amenity and natural character of the estuaries;

e) to support the social and cultural values of the estuaries and maintain safe public access and recreational amenity;

f) to acknowledge and support Aboriginal peoples' spiritual, social, customary and economic use of the study area and to protect local indigenous cultural heritage;

g) maintaining people's health safety and wellbeing generally is WAY outside of scope for a CMP.;

h) to recognise the coastal zone as a vital economic resource for the region and to support sustainable coastal economies;

i) to facilitate appropriate management of the coastal zone through ecologically sustainable development, and the promotion of sustainable land use planning and decision-making that is consistent with regional and local strategic plans;

j) to mitigate and manage current and future risks from population growth, urbanisation and coastal hazards, taking into account the effects of climate change;

k) to encourage co-ordination of the policies and activities of the relevant government and public authorities relating to the coastal zone - and to facilitate the proper integration of their management activities across all levels of government;

l) to maintain meaningful engagement with the community, and to support public participation in coastal management and planning, and to foster greater public awareness, education and understanding of coastal processes and management actions;

m) to encourage and facilitate research and monitoring – and to maintain scientific and educational values of the study area;

n) to support the objects of the *Marine Estate Management Act 2014*; and

4 STRATEGIC CONTEXT

As part of this Scoping Study, a review has been undertaken of the strategic context for coastal management to ensure that subsequent stages of the CMP address relevant management issues, and that the overall direction of the program is carefully considered. This task has been based on a review of existing information and data, and information supplied by project stakeholders via workshops undertaken during the study.

The strategic context for the CMP has been divided into a series of categories which are outlined in Table 4-1. Whilst these issues will be studied in further detail at later stages of the CMP, it is important to have a broad understanding at the project outset.

Table 4-1 Establishing the Strategic Context of the CMP

Context	Description of Strategic Context Drivers
Environmental	*What are the environmental features and processes affecting the coastal zone?* ▪ Regional geology and coastal geomorphology ▪ The predominant land use patterns across the catchment and projected future development ▪ Local coastal & estuary processes, including waves, water levels, winds, extreme events, sediment transport, erosion, storm tide inundation and water quality ▪ Local estuarine ecology, habitat extent and health, terrestrial biodiversity and catchment characteristics ▪ Potential climate change impacts
Governance	*What is the governance context of the CMP?* ▪ The political and governance context and the relationships between council and other public authorities
Policy	*What is the relevant legislation and policy governing the coastal zone?* ▪ The relevant local, state and federal legislation and policies, land tenure and land managed as national park or crown reserve
Management and Planning	*What is the strategic planning framework that the CMP must fit within?* ▪ The relevant coastal and estuary management plans in place across the study area ▪ Relevant state, regional and local plans and strategies
Economic	*What is the economic importance of the coastal zone?* ▪ The economic value of the estuaries – including the value of ecosystem services and the economic activity dependant on the coastal zone, such as tourism and agriculture
Social and Cultural	*What are the social and cultural values of the coastal zone?* ▪ Indigenous and non-indigenous heritage values of the study area ▪ Social and recreational uses of the study area ▪ Recreational infrastructure and coastal protection infrastructure
Population and Demographics	*What is the local population of coastal zone, and how may this change over future planning periods?* ▪ Population growth and demographic changes ▪ Major developments planned for the study area catchments

4.1 Environmental Context

4.1.1 Snapshot of the Estuaries

A snapshot of each of the four main estuaries is provided in Table 4-2, based on information provided in the relevant estuary studies and plans (see Section 6.1), NSW DPE, and other sources (Roy, et al., 2001; Roper, et al., 2011).

Table 4-2 Snapshot of Estuaries

Parameter	Khappinghat Creek[5]	Black Head Creek	Wallis Lake[1]	Smiths Lake[2]	Myall Lakes/ Lower Myall River Estuary[3]	Karuah Estuary[4]
Estuary Type	Saline coastal lagoon/ intermittently closed and open coastal lake or lagoon (ICOLL)	Saline coastal lagoon/ intermittently closed and open coastal lake or lagoon (ICOLL)	Wave-dominated saline barrier lagoon	Saline coastal lagoon/ intermittently closed and open coastal lake or lagoon (ICOLL)	Three interconnected freshwater/ brackish barrier lakes that drain via the Myall River, a wave-dominated inter-barrier estuary	Tide-dominated drowned river valley estuary
Estuary Evolution Stage	Mature	Mature	Young	Young	Young (lakes) and semi-mature (river)	Semi-mature
Entrance Conditions	Typically Closed and opens naturally without mechanical intervention	Typically closed	Open with entrance training walls	Typically closed and regularly mechanically opened	Open	Open
Estuary Area (km^2)	1.2	0.01	85.6	3.4	101 (lakes)/ 7.5 (river)	3.9
Estuary Volume (ML)	885	1.4	217,951	23,553	448,258	31,221
Average Depth (m)	0.9	0.2	2.3	2.4	4	2.2
Catchment Area (km^2)	90,73	2	1,420	33	1,501 (lakes)/ 1,660 (river)	2,200
Annual Rainfall (mm/yr)	1000-1500 (all)					
Disturbed Land Use (% catchment)	28%	92%	45%	22%	19%	35%
Mangroves (km^2)	0	279	0.8	0	3.0	3.5
Seagrass habitat (km^2)	0.003	0	30.8	2.1	2.0	0.4
Saltmarsh (km^2)	1.03	0	4	0	2.7	4.8

Key sources: [1] (Great Lakes Council, 2014), [2] (WBM, 2018), [3] (Umwelt, 2000), [4] (Great Lakes Council, 2015), [5] (Roper, et al., 2011)

4.1.2 Geomorphology and Estuary Classification

Geological Overview

The geological evolution of the MidCoast's estuaries is closely tied to past sea-level change. During low sea level stands, such as during the last glacial maximum around 20,000 years ago (i.e. the most recent "Ice Age") when sea level was around 120 m lower than present, rivers eroded bedrock and formed channels deeper than present sea level (Thom, Bowman, & Roy, 1981). When sea levels then rose, river valleys were submerged and marine sediments were deposited, forming a coastal plain. During the most recent Holocene marine transgression, which ended approximately 7,000 years ago (Sloss, 2007), marine sands were remobilised and deposited on top of and in front of the older Pleistocene coastal surface as sea level rose. The older Pleistocene (around 120,000 years old) inner-barrier sands are preserved as wedges in the near-shore, beach and dune areas. The deposition of more recent (less than 10,000 year old) Holocene outer barrier sands resulted in the formation of the present coastal barrier and beach complex (Roy P. , 1975).

Along most of the NSW coastline, the older Pleistocene tidal and delta deposits are covered by Holocene deposits and may have migrated laterally as a result of tidal activity. The continental shelf on this part of the coastline is relatively wide for the NSW coast; water depths of 20 to 100 m extend approximately 50 km from the coastline and the shelf sediments are predominantly terrestrially sourced sands (Roy, et al., 2001). The underlying geology of the area is predominantly metasediments and interbedded volcanics such as rhyolite and basalt (CG Skilbeck & Cawood, 1994). There are exposures of rhyolitic ignimbrites of the Nerong Volcanics in the Karuah area, including the Yacaaba and Tomare headlands (Geological Survey of NSW, 2014). Sedimentary rocks were also deposited by the areas, river systems, similar to the thick estuarine clays that currently fill many of the study area's bays.

Sediment Compartments

In order for the CMP to address issues related to coastal geomorphology (such as erosion and sedimentation within downstream estuary areas), it is crucial to understand the local sediment compartments that govern the sinks, sources, and pathways for coastal sediment transport. The CMP study area is situated across the "Port Stephens" and "NSW Mid-North Coast" primary sediment compartments. The "Port Stephens" compartment extends from Newcastle in the south, to Forster in the North. It spans Newcastle, Port Stephens, and MidCoast LGAs. The "NSW Mid-North Coast" compartment extends from Forster in the south, to South West Rocks in the north - and spans MidCoast, Port Macquarie Hastings and Kempsey LGAs (Geoscience Australia, 2021).

Within the Port Stephens primary sediment compartment, the coastal zone includes several secondary sediment compartments. The Karuah estuary and Lower Karuah River, North Arm Cove, and the Lower Myall River are within the "Port Stephens" secondary sediment compartment, as listed in Schedule 1 of the CM Act. The Myall Lakes are in the "Myall Lake", Smiths Lake is in the "Cape Hawke- Seal Rocks", and Wallis Lake is in the "Forster-Tuncurry" or the "Black Head–Cape Hawke" secondary sediment compartments, as listed in Schedule 1 of the CM Act.

These sediment compartments are listed in Table 4-3 and mapped in Figure 4-1 (Geoscience Australia, 2021).

Table 4-3 Coastal Sediment Compartments Covering the Study Area (as per GA, 2021)

Estuary	Secondary Sediment Compartment (as per CM Act)	Primary Sediment Compartment (as per GA, 2021)
Wallis Lake	Forster-Tuncurry or Black Head–Cape Hawke	NSW Mid-North Coast
Khappinghat Creek and Black Head	Manning River or Crowdy Head- Black Head	
Smiths Lake	Cape Hawke– Seal Rocks	Port Stephens
Myall Lakes	Myall Lakes	
Karuah Estuary	Port Stephens	

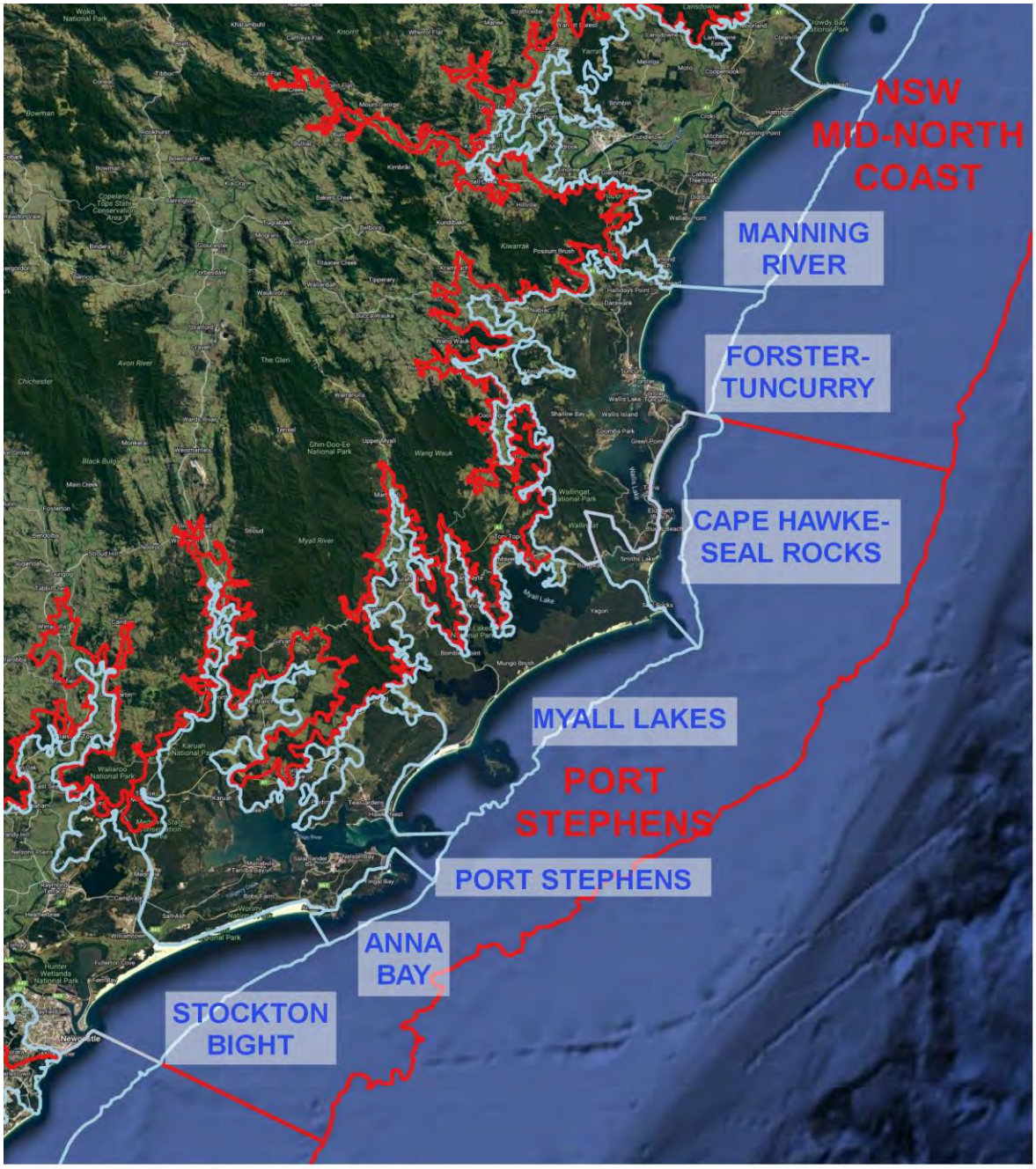

Figure 4-1 Coastal Sediment Compartments Covering the Study Area (as per GA, 2021)

4.1.3 Catchment Land Use

4.1.3.1 Historical Context

The study area generally sits within MidCoast region's broad coastal riverine plains, with the rivers extending up to the inland ridges and valleys. Generally, the upper sections of the larger estuaries (i.e., Karuah and Wallis) are characterised by steeper and narrower valleys, which become wider and flatter downstream.

The Worimi and Biripi people are the traditional custodians of the land. The settlements and land use practices of the Aboriginal peoples were strongly defined by the physical characteristics of the land, as the water supply determines vegetation and food availability. There is therefore a general correlation between cultural areas and major drainage basins (Great Lakes Council, 2015).

Early Europeans arrived in the area as early as the mid-1800s, initially drawn to the area for agricultural and timber prospects. The settlement of the Karuah catchment by Europeans is closely associated with the Australian Agricultural Company (AACo) (Great Lakes Council, 2015). There has been a history of clearing and draining wetlands to create farmlands, in addition to using cleared lands for poultry, dairy and beef cattle production from early European settlement of the area. There remain both large scale commercial (poultry and beef) and small-scale hobby farms throughout the study area (Great Lakes Council, 2015). The dredge harvesting and cultivation of natural oyster beds on Wallis Lakes began in the early 1880s, and the area remains one of the most significant producers of Sydney Rock Oysters in Australia.

The timber industry has been a major feature across the region but mostly of the Karuah and nearby catchments since early European settlement (i.e., from the early 1800's). This extended from the river flats and low-lying areas to the upper catchments. There remains significant timber forested land in the area both under private ownership and within State Forests. There is also a long history of mining in the study area, including for coal and ore.

Table 4-4 provides an overview of the land uses of the study area estuaries as of 2010.

Table 4-4 Estuary Land Use (Roper, et al., 2011)

Land Use Type	Khappinghat Creek	Black Head Lagoon	Wallis Lake	Smiths Lake	Myall Lakes/ Lower Myall River Estuary	Karuah Estuary
Undisturbed Forest (ha)	6,381	7	57,790	1,948	71,760	92,195
Cleared (ha)	3	0	208	6	9	44
Urban (ha)	1,267	56	7,836	737	3,367	2,470
Crops (ha)	0	0	174	0	7	30
Grazing (ha)	1,301	23	50,031	94	14,056	47,912
Irrigated Pasture (ha)	0	0	0	0	0	0
Dry Forb (ha)	3	0	25	0	0	0
Other (ha)	109	86	13,247	1,008	4,033	3,674

4.1.3.2 Urban Centres

The study area catchments contain several localised urban centres. The main villages and townships and their position within the study area catchments are shown in Table 4-5 (from roughly north to south). Population demographics are provided in Section 4.7.

Table 4-5 Urban Centres Within the Study Area

Township	Khappinghat Estuary	Black Head Lagoon	Wallis Lake	Smiths Lake	Myall Lakes/ Lower Myall River Estuary	Karuah Estuary
■ Forster-Tuncurry						
■ Coomba Park						
■ Elizabeth Beach						
■ Boomerang Beach/ Blueys Beach						
■ Smiths Lake						
■ Bungwahl						
■ Bulahdelah						
■ Tea Gardens						
■ Hawks Nest						
■ Pindimar						
■ Bundabah						
■ North Arm Cove						
■ Karuah						
■ Wallabi Point						
■ Black Head						
■ Hallidays Point						

4.1.3.3 National Park and State Forest

The study area also includes a significant portion of undeveloped bushland, national parks and state forests (as depicted in Table 4-4). This includes:

Khappinghat National Park

Khappinghat National Park is situated south-east of Taree and is approximately 3,547 ha including Khappinghat National Park (2020 ha), Khappinghat Nature Reserve (1494 ha) and Saltwater National Park (33 ha). The name 'Khappinghat' may be a derivation of 'Coppingithe' or 'Gapayn Gayith' in the Kattang language, which refers to 'having honey'.

The parks are of great cultural importance to the Biripi and Wormi people who have occupied this land for thousands of years. The diverse landscape, and plants and animal communities are now protected within the parks for the spiritual, cultural and physical sustenance of Aboriginal people. Saltwater, Khappinghat Creek, Saltwater Headland and surrounds, contain many Aboriginal sites encompassing coastal camping sites, ceremonial site, middens and burial sites (See Figure 4-2). Part of Saltwater National Park is used as a seasonal camping area for traditional owners, their families and their guests under a memorandum of understanding (MOU) established between the NSW National Parks and Wildlife Service (NPWS) and the Saltwater Tribal Council (NPWS, 2019).

The parks contain four threatened ecological communities listed under the Biodiversity Conservation Act 2016 (BC Act), which are littoral rainforest, freshwater wetlands, swamp sclerophyll forest, river-flat Eucalypt Forest. In addition, it supports range of native animals, including three endangered and 13 vulnerable animal species listed under the BC Act.

The parks are used for varied recreational and tourism activities. The parks provide access to Khappinghat Creek and is used for walking, cycling, vehicle touring and horse riding. The most popular existing tracks are the Five Islands Track on the northern shore of Khappinghat Creek and the Saltwater Headland Walk. Saltwater Beach and Wallabi beach are popular surfing sites.

Figure 4-2 Khappinghat National Park (Source: cycle4retirement.com.au)

Figure 4-3 Saltwater Aboriginal Site, Khappinghat National Park (Source: NPWS)

- **Booti Booti National Park** - a popular park for day and overnight visitors sitting on an 8 km peninsula between the coastline and Wallis Lake, and includes rainforest, dry sclerophyll forest communities, sand dune habitats, and rocky headland areas (See Figure 4-4).
- **Wallingat National Park** is on the western shore of Wallis Lake, and contains diverse forest, swamp and wetland areas. It contains campgrounds and several popular walking tracks.
- **Myall Lakes National Park** includes the entire Myall Lakes area and 40 km of beaches and sand dunes, and is one of the most popular National Parks in the state (See Figure 4-4). It includes diverse coastal

environments including the freshwater lakes, ocean, islands, native flora, dense littoral rainforest and beaches. The Myall Lakes have been listed under the Ramsar Convention since 1999.

- **Karuah National Park** is approximately 3,500 ha large and is popular for 4WDing, bushwalking, fishing and camping.

  There are also numerous smaller nature reserves adjacent to the study area estuaries including around Wallis and Smiths Lakes.

Figure 4-4 Booti Booti National Park (Left) and Myall Lakes National Park (Right) (Source: NPWS).

4.1.3.4 Aquaculture

The MidCoast region is one of Australia's oldest and most significant producers of oysters. Total oyster production in 2017-2018 had a total value of $12.8 million in the LGA. This represented 25% of the NSW total oyster production value (MidCoast Council, 2021). Oysters are an important export, as well as a draw for food-based or gastronomic tourism in the area. In general, productivity of the oyster industry is highly seasonal and dependent on weather conditions and water quality. There are active oyster leases (see Figure 4-5) on Wallis Lake, the mouth of the Myall River, and in Port Stephens. There are also active oyster reef restoration projects occurring in the Port Stephens-Great Lakes Marine Park and Wallamba River (Department of Primary Industries, 2020).

Figure 4-5 Sydney Rock Oyster Aquaculture in Wallis Lake (Source: barclayoysters.com.au)

4.1.3.5 Extractive Land Uses

The study area includes several extractive operators, which operate under an Environmental Protection Licence (EPL) issued by the NSW EPA. These include:

- Hunter Quarries, which is a gravel road base crushed stone quarry located by Andesite Road and Branch Lane in Karuah with an extractive activities licence number 11569.
- Karuah East Quarry which is an andesite quarry located on the Pacific Highway in Karuah with an extractive activities licence number 20611.

  Open-cut coal mining is relatively new in the Karuah catchment and is happening on a small scale.

4.1.4 Port Stephens–Great Lakes Marine Park

The Port Stephens-Great Lakes Marine Park is approximately 980 km^2 and extends from Forster to the northern end of Stockton Beach. It includes:

- offshore waters to the three nautical mile limit of NSW waters; and
- all of Port Stephens, the Karuah River, the Myall River, Myall and Smiths Lakes, and their creeks and tributaries to the tidal limit.

The park protects Port Stephens, Myall Lakes, Smiths Lake, as well as several offshore islands. It contains a range of habitats with diverse estuaries and open coastlines and is home to diverse marine and estuarine fauna.

1. The primary purpose of a marine park is to conserve the biological diversity, and maintain ecosystem integrity and ecosystem function, of bioregions in the marine estate.
2. The secondary purposes of a marine park are, where consistent with the primary purpose —
   a. to provide for the management and use of resources in the marine park in a manner that is consistent with the principles of ecologically sustainable development, and
   b. to enable the marine park to be used for scientific research and education, and
   c. to provide opportunities for public appreciation and enjoyment of the marine park, and
   d. to support Aboriginal cultural uses of the marine park.

The Port Stephens-Great Lakes Marine Park zoning scheme enhances conservation of estuarine and marine habitats and species by providing various levels of protection whilst allowing for multiple uses. The four types of zones that are applied in NSW marine parks are sanctuary zones, habitat protection zone, general use zones and special purpose zones. . Parts of Smiths Lake, Myall Lakes, the lower Myall River, North Arm Cove, and Port Stephens by the mouth of the Karuah River are all Sanctuary Zones, which provide the highest level of protection for habitats, animals and plants, ecological processes, natural features and areas of cultural significance by allowing only activities that do not harm plants, animals or habitats (Figure 4-6).

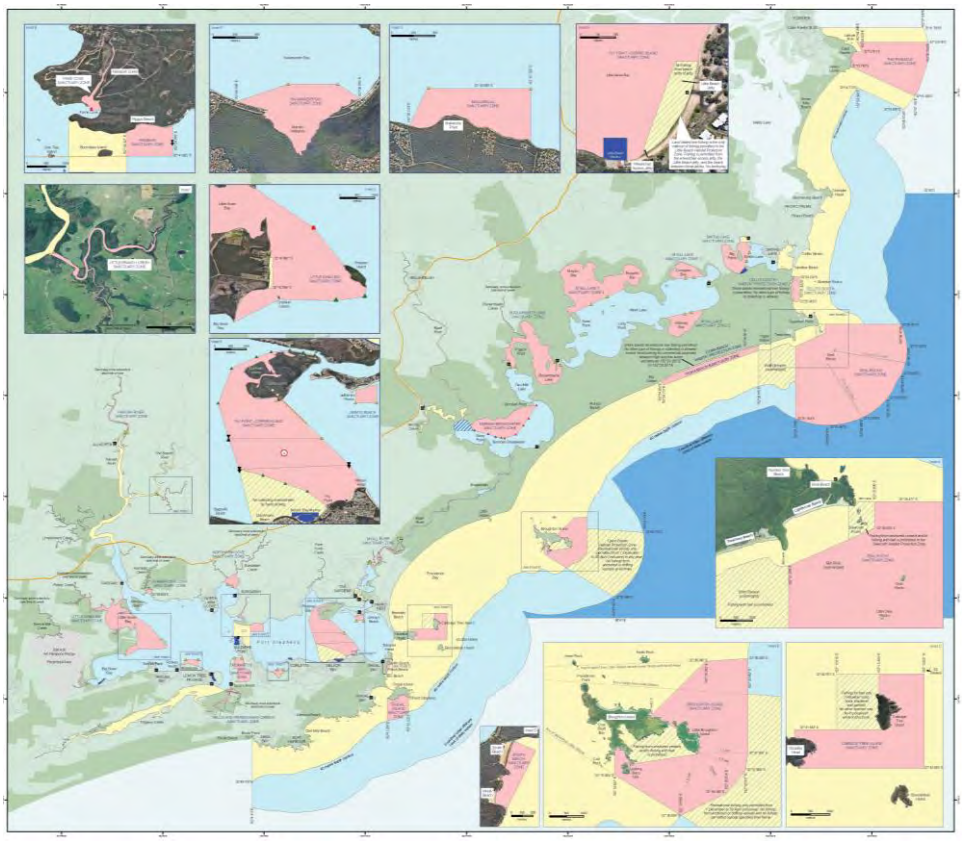

Figure 4-6 Port Stephens – Great Lakes Marine Park Zoning Map

4.1.5 Physical Processes

4.1.5.1 Estuarine Morphodynamics

The five (5) main estuaries of Wallis Lake, Smiths Lake, Myall Lakes, Khappinghat and Karuah River/Port Stephens investigated in this study behave in varying ways and are classified accordingly.

Wallis Lake

Wallis Lake is classified as a large, saline barrier lagoon system (Great Lakes Council, 2014) with a permanent entrance due to the construction of training walls. These training walls, which commenced construction over 110 years ago (WorleyParsons, 2011), have significantly impacted the natural estuarine processes and tidal regime of the lake. They have triggered an increased in the tidal range, resulting in increased amounts of tidal exchange, including sediment transport, between the lake and ocean (Great Lakes Council, 2014) - see Figure 4-7.The northern sections of the lake are more heavily influenced by the marine parameters than the southern end (Great Lakes Council, 2014).

With a permanent entrance, the source of sediment entering the estuary is the beach and surf zone immediately adjacent to the entrance, with waves playing an important role in the delivery of that sediment. Wave stirring of sediments at the seaward end of the entrance channel and in the adjacent surf zone acts to suspend sediment that can be transported into the estuary by tidal currents. Once sediment is inside the channel, its transport is controlled by the tide-related currents. The result is a net transport of sediment into the lagoon entrance, which results in the formation of a flood tide delta in the downstream region of the estuary.

The tide delta in Wallis Lake is continually growing and it is possible that could take 375 years to reach a new equilibrium (Nielsen & Gordon, 2008).

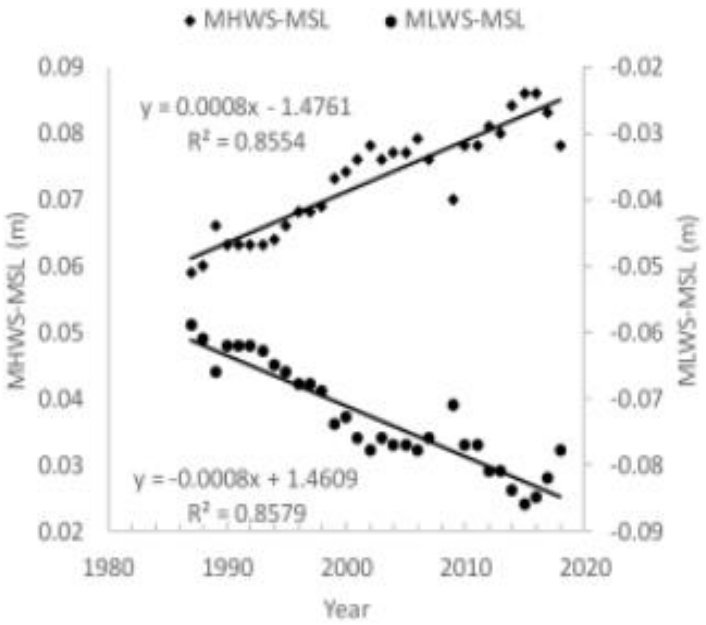

Figure 4-7 Impact of Training wall installation on tidal range of Wallis Lake (Gordon & Nielsen, 2020)

Smiths Lake

Smiths Lake is typically a closed system that intermittently opens to the ocean and is therefore classified as an Intermittently Closed and Open Lake or Lagoon (ICOLL) (Haines, Tominlinson, & Thom, 2006). ICOLLs and coastal creeks are narrow, generally shallow water bodies that develop on prograding coastal sequences formed from beach ridges, dunes and barriers. In ICOLLs, the state of the entrance (either open or closed) is a function of the balance between coastal processes (sedimentary and wave) which act to fill the entrance with sediment until closure, and catchment processes (and residual effects of event-based catchment runoff) which act to scour out the entrance and keep it open (Haines, Tominlinson, & Thom, 2006).

The ocean entrance of Smiths Lake, located across a wide sandy beach called Sandbar Beach, has been mechanically opened by Council once identified trigger levels are reached (on average every 18 months) since 1932 and remains open for around 2 months (Webb, McKeown & Associates, 1998). This is undertaken to prevent and avoid flooding problems and inundation of low-lying properties or improve water quality (Webb, McKeown & Associates, 2008; 1998). Prior to 1999, the trigger level for opening the lake was a water level of 1.7 m AHD, however this was adjusted to 2.1 m AHD in 1999 as part of a formal entrance opening policy in order to reduce the number of openings to more closely replicate the natural opening regime (Webb, McKeown & Associates, 2008). It is possible that without human intervention the crest of the berm would exceed 3 m AHD and thus flooding events would have to reach this level before overtopping, scouring and opening would occur (Webb, McKeown & Associates, 2008). Under the current opening policy of 2.1 m AHD, the lake is opened at least twice as often as it would naturally (Webb, McKeown & Associates, 2008).

During periods when the lake is open to the ocean, the lake is subject to the oceanic tidal regime, swell and currents providing the lake with sand that forms an extensive marine tidal delta that extends over most of the entrance area (Great Lakes Council, 2009). When closed, there is limited water and thus sediment flowing into

the lake due to the small catchment with only a few small creek networks suppling the lake with water, including Wamwarra and Tarbuck creeks (Great Lakes Council, 2009).

Myall Lakes and Lower Myall River estuary

The Myall Lakes consist of a series of three interconnected freshwater/brackish lakes (Bombah Broadwater, Boolambayte Lake and Myall Lake) which drain into Port Stephens via the Myall River. The Lower Myall River estuary is located at the mouth of the river at Tea Gardens and is exposed to swell and tidal currents from Port Stephens.

A complex interaction occurs between the Myall Lakes and the downstream discharge through the Lower Myall River, which is heavily influenced by the local rainfall. During high rainfall events, the small and lengthy outlet of the Myall River causes the Myall Lakes, particularly Bombah Broadwater, to store catchment runoff and act as reservoirs causing water levels to reach up to 1.5 m above sea level. Drainage of this runoff via the river can take up to 3 months before the lakes reach 0.1 m above sea level, at which point outflow ceases. During periods of low rainfall, flow can be reversed, with extensive saltwater flow up the Lower Myall River, causing Bombah Broadwater to reach brackish salinity (DECCW: Coastal Waters Science Unit, 2010). The accumulation of catchment runoff and long residence time in the lakes can cause issues with water quality.

Karuah River/ Port Stephens

The Port Stephens estuary, and subsequent Karuah River estuary, is classified as a tide-dominated drowned river valley (Roy, et al., 2001). The Port is generally compartmentalised into the Inner Port (areas west of Soldier Point) and Outer Port (areas east of Soldier Point), due to the differing estuarine processes experienced either side of this divide. The Inner Port, which includes the Karuah River estuary, is dominated by fluvial processes and is characterised by wide mud flats with mangrove and saltmarsh shorelines (Umwelt, 2009). Sediment in this area originates from the Karuah River with tidal currents and wind waves being responsible for dispersal and resuspending of these sediments though the Inner Port. The Outer Port is dominated by tidal and wave processes due to it being exposed to the ocean. The sediment composition, mostly sand, and form in these areas is predominantly tidal in origin. An extensive flood tide delta extends across the entrance to Port Stephens which formed during the Holocene period by the complex interactions of tides, waves and minor flows from the Lower Myall River along the northern shore (BMT WBM, 2011).

4.1.5.2 Tides and Storm Tides

The tides in the study area are dependent on the state of the water body and its connectivity with the ocean. Wallis Lake and Port Stephens/Karuah River estuaries are permanently connected to the ocean and therefore experience continued tidal regimes. Smiths Lake is an ICOLL that experiences intermittent tidal flows. However, the Myall Lakes are classified as freshwater bodies due to the lack of interaction with the ocean and therefore have no tidal regime.

The tides experienced in the study estuaries are semi diurnal with diurnal inequalities. That is, there are two high tides and two low tides per day that are generally at different levels in any one day. The tide range is around 1.6 m (Wallis Lake entrance) to 2 m (Tomaree) along the open coastline, with a highest astronomical tide (HAT) of around +1.13 m AHD. Smiths Lake, when open, experiences a mean tidal range of approximately 1 m and a maximum tidal range of 2 m. The peak tidal water level is around 1.1 m AHD however can increase to exceed 2 m AHD with storm surge and wave setup (Webb, McKeown & Associates, 2008).

The Wallis Lake estuary experiences an attenuated tidal range relative to the open ocean, due to hydraulic energy losses through the narrow and shallow entrance. There is extensive tidal exchange of water through the estuary entrance which results in significant scouring of the channel.

The tidal range within the Wallis Lake and Port Stephens (used for Karuah River) estuaries is provided in Table 4-6, as reproduced from OEH (2012). There are no tidal ranges provided for Smiths and the upper Myall Lakes due to the limited time or lack of time these estuaries are exposed to tidal regimes.

Table 4-6 Tidal Planes for the study area estuaries that are permanently open (OEH, 2012)

Astronomical Tidal Plane (m AHD)	Wallis Lake			Port Stephens (Mallabula Point)
	Entrance	Tiona	Wallamba River	
Higher High Water Springs Solstice (HHWSS)	0.80	0.20	0.31	1.13
Mean High Water Springs (MHWS)	0.49	0.11	0.19	0.69
Mean High Water Neaps (MHWN)	0.31	0.09	0.14	0.42
Mean Sea Level (MSL)	-0.07	0.04	0.06	-0.01
Mean Low Water Neaps (MLWN)	-0.40	-0.01	-0.03	-0.44
Mean Low Water Springs (MLWS)	-0.63	-0.03	-0.07	-0.71
Indian Spring Low Water (ISWL)	-0.85	-0.09	-0.16	-0.99

Additionally, elevated water levels occur during storms as a combination of storm tide (tide plus surge due to barometric pressure and wind setup), wave setup and wave runup. The wave run up mechanism can result in the overtopping of coastal barriers impacting on water levels in estuaries and potentially lead to opening of the estuary entrance.

4.1.5.3 Catchment Hydrology

The regional climate in the MidCoast area is humid sub-tropical with typically warm to hot summers and mild winters. On average, the region experiences a mostly summer rainfall regime with an annual average rainfall of between 1000 - 1500mm with peak flows experienced in March (Hunter & Central Coast Regional Environmental Management Strategy, 2009). Much of the catchment area for the study estuaries is largely undeveloped (especially for Smiths Lake) due to the presence of conservation areas including the Wallingat, Booti Booti, Myall Lakes and Karuah National Parks, and State Forests.

4.1.5.4 Storm Events and Flooding

The MidCoast coastal zone is periodically exposed to storm activity originating in the sub-tropics of the north and the mid-latitudes of the south. To the north are tropical cyclones, which occur during the summer months, and depressions developing into easterly troughs. Further south, low pressure systems such as cut-off lows, migratory lows and east coast lows are a major source of severe weather, particularly in the colder months (WBM Oceanics, 2005). These systems are all capable of generating storm surges, severe wave conditions, storm erosion and catchment flooding across the coastal zone.

There is a long history of flooding in the MidCoast LGA. A number of floods are known to have occurred in the region since the late 1800s, including major flooding events in 1890s, 1927, 1956, 1963, 1974, 1977 and 1978 (WMA Water, 2014; BMT WBM, 2015). Historical highest recorded floods in the area was that of the 1927 flood, which reached a level of 2.3 m AHD in the Wallis Lake area (WMA Water, 2014) and 2.7 – 3.4 m AHD in the Myall Lakes (BMT WBM, 2015). Unfortunately, there is limited historical flood data for locations around Wallis Lake despite known floods occurring (Webb, McKeown & Associates, 2008). The recent flooding levels in 2021 in the study area were much higher at 4.0 m ADH at Nabiac in Wallis Lake and was 4.3 m ADH at Bulahdelah in Myall lakes (see Table 4-7).

Recent studies have indicated that in Wallis Lake, oceanic storm tides dominate downstream of the Forster Tuncurry Bridge, while catchment flooding dominates upstream of the bridge (WMA Water, 2014). The current estimate for a 1% AEP flood level in Wallis Lake is around 1.9 m AHD (Webb, McKeown & Associates, 2008) which is similar to that for Karuah River of 1.91 m AHD (Great Lakes Council, 2010), Lower Myall River at Tea Gardens of 1.79 m AHD (BMT WBM, 2015) and Port Stephens entrance of 1.50 m AHD (BMT WBM, 2015).

Flooding in the Smiths Lake area has largely been avoided due to the opening policy in place to mechanically open the entrance once the lake water level reaches 2.1 m AHD to avoid flooding of the surrounding areas.

Emergency planning and response for these estuaries are provided in the various Floodplain Risk Management Plans, discussed in Section 6.1

Table 4-7 Recent flooding (2021) level recorded by council within the study area

Catchment	Location	Modelled Peak 1% AEP (m AHD)	Recorded Peak (m AHD)	Event	Confidence/ Comments
Wallis Lake	Nabiac	4.75	4	5% AEP (3.97m AHD)	Low. Rough gauging at 205 Aerodrome Road Nabiac… not enough gauging on the Nabiac end of the Wallamba.
	Tuncurry (Chapmans Rd)	2.19	1.400	<20% AEP	High. Minimal tide/surge resulted in a small event.
	Tuncurry (Point Rd)	1.95	1.067	<20% AEP	High. Minimal tide/surge resulted in a small event.
	Pacific Palms	1.95	1.061	<20% AEP	High. Minimal tide/surge resulted in a small event.
Myall River	Bulahdelah	5.87	4.306	<5% AEP	High
	Bombah Point and Nerong Village	2.38	2.89	>1% AEP	High
	Tea Gardens	1.4	1.065	<5% AEP	High. Largely tidally driven.

4.1.5.5 Wave Climate

The regional wave climate is a dominant factor amongst local coastal processes. The offshore (deep water) wave climate of the northern NSW coast comprises a highly variable wind wave (local seas) climate, combined with a persistent long period, moderate to high energy east to south-easterly Tasman Sea swell. Modal offshore significant wave heights are in the range of 0.5 - 2.0 m, with spectral peak periods predominantly in the range 7 - 12 seconds (Shand, et al., 2011). Local wave heights in the vicinity of the estuary entrances are generally of lower energy, as those foreshores are offered a significant amount of protection from local

topographic features, such as protruding rocky headlands (Port Stephens/Karuah River), beach dunes and breakwaters (Wallis Lake and Smiths Lake). Open coast beaches of NSW experience wave setup of up to 1.5 m which has been shown to be much less than this for shallow trained ocean entrances such as Wallis Lake (Dunn, Nielsen, & Per, 1999). When the estuaries are open to the ocean there may be limited penetration of ocean swell through the entrance, though significant energy dissipation is incurred in the process. The wave climate within the mid to upper estuaries is dominated by local sea waves generated by local winds blowing across the various fetches of the estuary bodies.

4.1.6 Water and Sediment Quality

Water quality in estuaries is driven by a complicated web of interconnected processes. Catchment inputs are a key factor determining the quality of water within the estuary. The land use, hydrology, soil type and geography of a catchment all combine to determine the loads of nutrients and sediments delivered to the waterway.

Tidal exchange is a major process controlling water quality in the study area estuaries. The entrances to Wallis Lake and Port Stephens are permanently open, meaning tidal exchange is relatively consistent while Smiths Lake is opened intermittently. During outgoing tides nutrients and sediment suspended in the water column are flushed out to sea, representing a net loss of these constituents from the system. However, during incoming tides oceanic waters can act as a significant source of nutrients and sediments when rough surf conditions result in the disturbance of marine sediments, or when cold water upwelling events occur, for example, after extended periods of strong north-east winds.

A variety of water quality data for across the study area has been collected in past and present monitoring programs. This includes water quality sampling undertaken as part of the *Waterways and Catchment Report Card Program* (MidCoast Council, 2021) with the water quality scores for each estuary provided in below (see Table 4-8 and Figure 4-8).

Table 4-8 Waterways and catchment report card program scores for study estuaries

Location		First Reporting Score (Date)	2021 Rating
Khappinghat Creek	Khappinghat Estuary	B (2010)	C
Black Head Lagoon	Lower Estuary	C (2011)	E
Wallis Lake	Mid Wallamba Estuary	D (2007)	B
	Wallamba Cove	C (2014)	C
	Coolongolook Estuary	B (2017)	B
	Pipers Creek	B (2007)	B
	Wallis Lake	A (2007)	A
	Charlotte Bay	A (2007)	A
Myall Lakes	Bombah Broadwater	B (2007)	B
	Myall Lake	B (2012)	A
	Lower Myall Lake	B (2011)	B
Karuah River Estuary		C (2012)	B
Smiths Lake		A (2011)	A

Grade	Result	Definition	Description
A	Excellent	All environmental values met (The indicators measured meet all of trigger values for almost all of the year)	The best 20% of scores in the State
B	Good	Most environmental values met (The indicators measured meet all of the trigger values for most of the year)	Next 30% of good scores
C	Fair	Some of the environmental values met (The indicators measured meet some of the trigger values for some of the year)	Middle 30% of scores
D	Poor	Few of the environmental values met (The indicators measured meet few of the trigger values for some of the year)	Next 15% of poorer scores
F	Very Poor	None of the environmental values met (The indicators measured meet none of the trigger values for almost all of the year)	The worst 5% of scores in the State

Figure 4-8 Water Quality Report Card Grades (Source: MidCoast Council, 2019)

These results indicate that the health of the estuaries with respect to water quality is moderate to excellent. The causes of water quality issues across the study area are discussed further in the First Pass Risk Assessment in Section 8.4, but are generally related to:

- Runoff from residential, commercial and industrial areas; and.
- Impacts of runoff from agricultural land usage.

A summary of the water quality and the issues influencing water quality within each of the study area estuaries is provided below:

Khappinghat Estuary

This estuary is surrounded by the Khappinghat Nature Reserve with generally excellent to good water quality water due its excellent ecological condition. However, the water quality rating has continued to be moderate since 2019 due to algal growth and poor water clarity resulted in a fair grade (MidCoast Council, 2021). This possibly could be attributed to

- The catchment having one of its wettest summers since 1996, with two large rainfall events resulting in opening of the estuary entrance. This may have caused the turbidity levels to exceed the guideline values.
- Bushfires of 2020 in the Khappinghat catchment may also have added nutrients to the system contributing to the algal growth which also exceeded the guidelines values. Before 2019, Khappinghat had excellent/good water quality rating except in 2012.

Black Head Lagoon

The Black Head lagoon is not monitored annually under The Waterways and Catchment Report Card Program (MidCoast Council, 2021) of the Council. It is monitored as a part of the state monitoring program which samples estuaries every three year. The most recent sampling at the lagoon was completed over 2018-2019 and the resultant grade was very poor.

The water quality in Black Head lagoon heavily influence by the urban development and centre around its catchment. The estuary has abundance of algae and poor water quality. Overall, the estuary heath is graded very poor. The water quality has deteriorated from excellent in 2010 to very poor currently. The inordinate algal numbers may have been triggered due to excessive clearing of bush land to make way for new developments, resulting in surplus sediments and nutrients in the water.

Wallis Lake

Due to the size of Wallis Lake, different areas have varying water quality and issues promoting these differences in quality. The *Waterways and Catchment Report Card Program* (MidCoast Council, 2021) and *WQIP* (2009) found that:

- The southern regions of the lake, including the main lake body and Charlotte Bay have excellent water quality with respect to clarity and algal concentration.
- Areas around Tuncurry, including Mid Wallamba Estuary and Wallamba Cove, experienced moderate water clarity issues and increased nutrient concentrations which result in increased algal growth and poor seagrass distribution.
- The western areas of Coolongolook estuary have higher algal concentrations but good water clarity.
- The water quality in the lake has improved since the Hepatitis A outbreak that plagued the estuary in 1997 due to the introduction of robust management and monitoring programs. The initial testing in 2006/07 identified the lake as being above natural conditions with respect to algal concentrations and turbidity.

Prior to 1990, the area had history of clearing of the catchment and riparian zones, and draining, infilling and mining of coastal wetlands and barrier dunes which created problems of erosion, sedimentation and eutrophication.

Smiths Lake

Smiths Lake has been shown to have only minor issues regarding water quality and is historically relatively healthy compared with developed catchments (BMT WBM, 2018). This is due to the relatively steep and infertile nature of the catchment causing low levels of development and clearing. Much of the catchment is national park or native vegetation which reduces runoff and erosion and decreases pollutant loads entering the lake. According to numerical modelling undertaken by Everett (2007), this high forested catchment and relatively small catchment to lake ratio allows the lake to assimilate its current nutrient loads and can accommodate increases of up to 10 times, regardless of the opening cycle length and open phase. Despite this, the few issues surrounding water quality in the lake identified in the *WQIP* (Great Lakes Council, 2009) include:

- Stormwater runoff from urban centres and low vegetation areas on the steep catchment slopes and unpaved roads leads to increased erosion and nutrient transport into the lake resulting in decreases in water quality, specifically turbidity and algal concentration.
- To create a buffer within the lake to better respond to storm events and increased runoff, a 3% reduction in chlorophyll concentrations was identified. This required reducing the current loads of total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) by 6.7%, 7.3% and 2.7% respectively to reach the target.

Myall Lakes and Myall River Estuary

The Myall Lakes system is sensitive to any increase in pollutant loads due to the lack of connectivity across most of system to the ocean and the tidal flushing this provides. The area has a history of toxic blue-green algal blooms, with the last major occurrence in 1999. The water quality within the Myall Lakes differs between the different lakes. The *Waterways and Catchment Report Card Program* (MidCoast Council, 2021) and *WQIP* (Great Lakes Council, 2009) determined that:

- Much of the Myall Lake catchment is protected by national parks which provides a substantial buffer against deteriorating water quality and is the reason for high water quality in the upper lakes.
- Both Myall Lake(which has very limited tidal exchange) and Lower Myall River estuary (which experiences tidal flushing) had good water quality with respect to algal concentration and water clarity in 2021 (MidCoast Council, 2021).
- Bombah Broadwater, the most downstream lake, experiences the lowest water quality in the lake system. It was classified as being in a modified condition based on 2006/07 testing (Great Lakes Council, 2009) due to the lake being the receiving water for several sub catchments combining for 76% of the total catchment area which contributes 81%, 79% and 84% of the TSS, TN and TP respectively. These nutrient loads, combined with long water retention times and low flushing cause the algal concentrations of the lake to exceed guideline trigger levels by a moderate amount increasing its susceptibility to algal blooms.

Karuah Estuary/Port Stephens

The water quality along the northern shore of Port Stephens, especially in the Outer Port, is good quality due to the tidal flushing and connectivity to the ocean. There have been some areas of concern identified in both Karuah River estuary and Lower Myall River at Tea Gardens which include:

- High turbidity in the Karuah River attributed to erosion in the catchment which has caused low light availability and a reduction in seagrasses in the area of up to 80% between 1985 and 2009 (Great Lakes Council, 2015).

4.1.6.1 Acid Sulfate Soils

Acid sulfate soils (ASS) are sediments deposited under estuarine conditions that contain the sulfidic mineral pyrite. Generally speaking, ASS materials do not pose a problem if left undisturbed in the subsurface. However, they pose a risk if exposed to air by excavation or the lowering of the water table, as the iron sulfides they contain react with oxygen to create and release sulfuric acid and acid leachates in toxic amounts (DPIE, 2021). Acid runoff from disturbed ASS in agricultural, urban and general drainage works on lands adjacent to the estuary can have potentially harmful impacts on ecology, aquaculture and recreational amenity.

There are several classes of ASS depending on the likelihood of an area being exposed to them. These risk levels are

- Class 1: ASS likely to be found on and below the natural ground surface.
- Class 2: ASS likely to be found below the natural ground surface.
- Class 3: ASS likely to be found beyond 1 metre below the natural ground surface.
- Class 4: ASS likely to be found beyond 2 metres below the natural ground surface.
- Class 5: ASS not typically found in Class 5 areas. Areas classified as Class 5 are located within 500 metres on adjacent class 1,2,3 or 4 land.

Using the NSW SEED Portal (NSW Government, 2022), the risk of ASS occurring in each estuary was assessed. This determined that all the estuaries and waterways within the study area are classified as Class 1 indicating a high probability of the presence of ASS in the soil profile. Much of the low-lying areas surrounding

the water bodies, particularly in the central and northern sections of Wallis Lake, the central and southern sections of the Myall Lakes extending through to Port Stephens at Tea Gardens, and areas directly adjacent to the Karuah River are classified as Class 2 and are therefore also likely to contain ASS in the soil.

4.1.6.2 Summary

To assess the risk of land-use pressures and the consequent risks of the impacts on ecological health across the study estuary sub catchments, the NSW Estuary Health Risk Dataset from the NSW SEED Portal (NSW Government, 2022) was used. This dataset includes consequences (Figure 4-9), likelihood (Figure 4-10) and risk (Figure 4-11) data for each of the study estuaries and their catchments. Likelihood scores represent the extent and intensity of land-use pressure from each sub catchment, with a score of 1 indicating the lowest likelihood of impact and a score of 4 the highest likelihood of impact on estuary health. Consequence scores represent the extent of impact on estuary health, with a score of 1 indicating the lowest chance of impact and a score of 4 indicating the highest chance of impact. Risk is a product of the likelihood and consequence scores (i.e., likelihood x consequence = risk), with a maximum score of 16 indicating the greatest risk and a score of 1 indicating the lowest risk. The method for calculating risk scores follows the procedure outlined in the NSW Treasury's Risk Management Toolkit (DPIE, 2019b).

This dataset also includes nutrient load data including total nitrogen (TN) (Figure 4-12), total phosphorus (TP) (Figure 4-13) and total suspended sediment (TSS) (Figure 4-14) which provides context for the likelihood scores and are presented as total export from the sub catchment (kilograms/year). Higher combined export values of these parameters for the sub catchments results in higher likelihood of ecological impact. Areas with the largest risk of ecological impact include the northern sub catchments of the Wallis Lake catchment and the Lower Myall River sub catchments. These areas correlate to those with agricultural land use resulting in the greatest export of TN, TP and TSS resulting in an increased likelihood and thus increased risk.

This dataset also includes nutrient load data including total nitrogen (TN) (Figure 4-10), total phosphorus (TP) (Figure 4-11) and total suspended sediment (TSS) (Figure 4-12) which provides context for the likelihood scores and are presented as total export from the sub catchment (kilograms/year). Higher combined export values of these parameters for the sub catchments results in higher likelihood of ecological impact.

Areas with the largest risk of ecological impact include the northern sub catchments of the Wallis Lake catchment, northern sub catchments of the Smiths Lake catchment and the Lower Myall River sub catchments. These areas correlate to those with agricultural land use resulting in the greatest export of TN, TP and TSS resulting in an increased likelihood and thus increased risk.

Within the study area, the areas with a risk score of 16, which are most at risk to ecological impacts (i.e. a likelihood and consequence score of 4), are found in the Smiths Lake and Lower Myall River catchments. The north-western areas of the Smiths Lake catchment, around Tarbuck bay and Big Point, and around the Smiths Lake township, are the areas of concern around Smiths Lake. This is likely attributed to the steep slopes in the Smiths Lake catchment and land clearing occurring in these areas causing an increase in pollutant runoff (i.e., Nitrogen, phosphorus and sediment). Although the extent of disturbance is relatively low in these areas compared to other catchments, due to the small catchment size of Smiths Lake even small disturbances can result in significant impacts on ecological health.

Areas adjacent to the north-western bank of the Lower Myall River, where agricultural practices are prevalent (particularly tree farming) correlate to the areas most at risk in this region. The small catchment of the Lower Myall can concentrate these impacts from agriculture more intensely causing a greater risk to ecological health. Due to the sub catchments adjacent to Wallis Lake and Myall Lake remaining relatively well forested they have few areas with increased risk to ecological health.

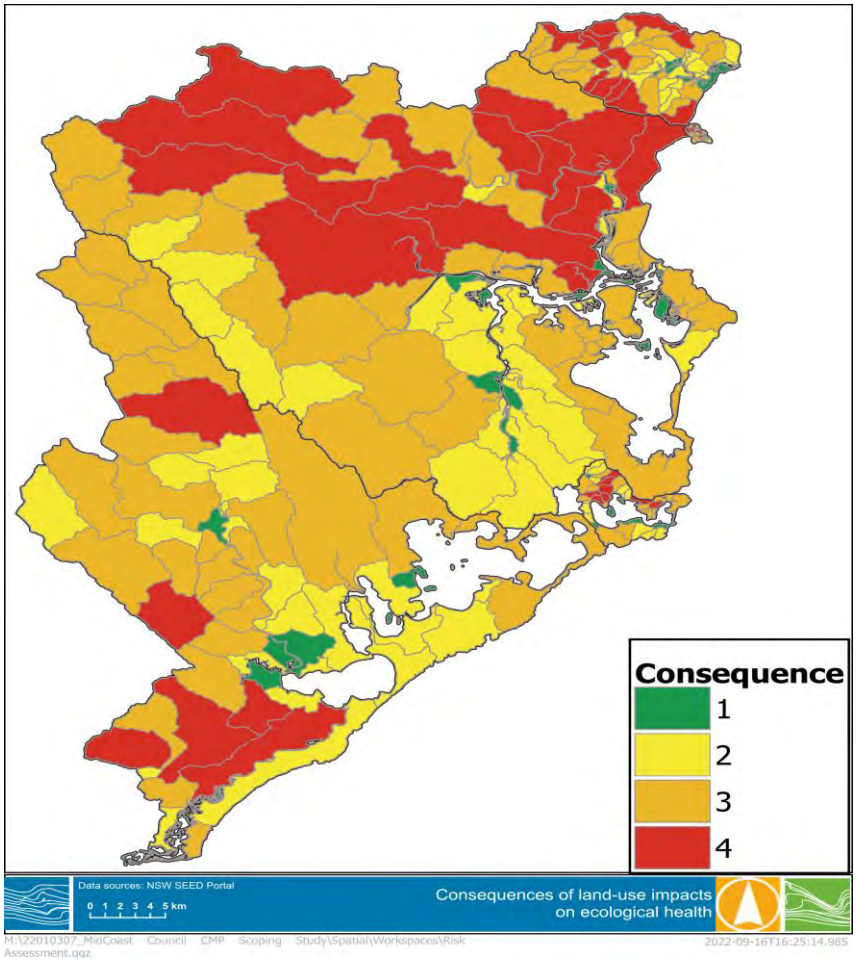

Figure 4-9 Consequence scores represent the extent of impact on estuary health

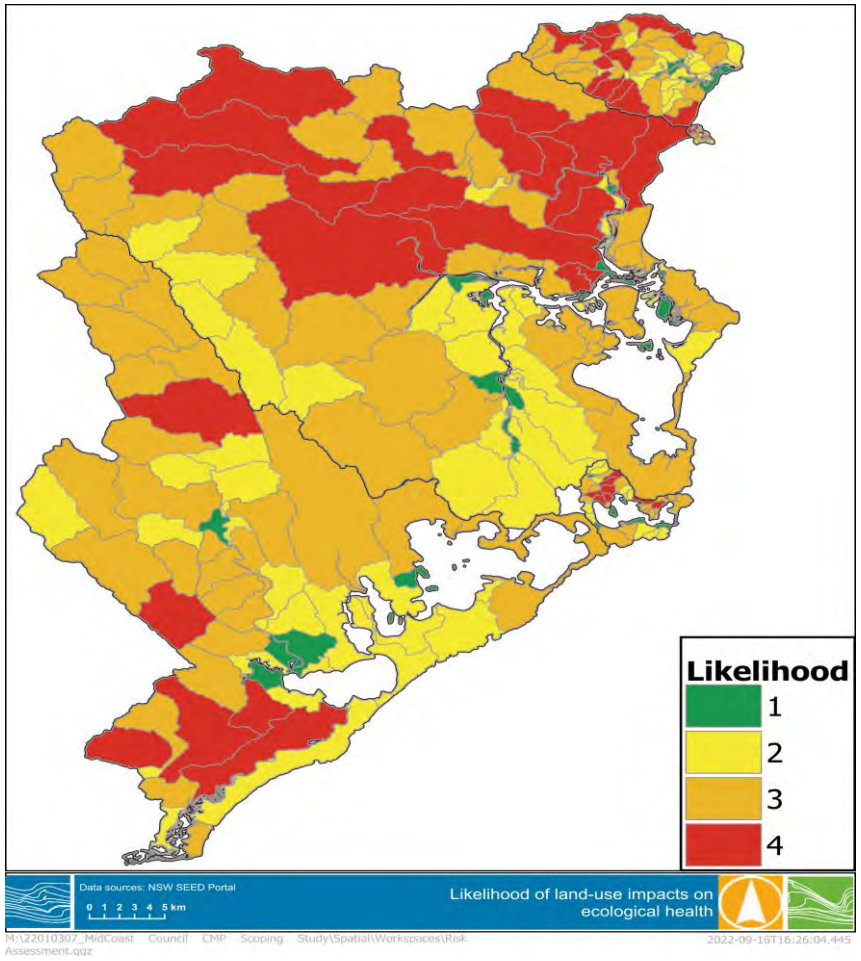

Figure 4-10 Likelihood scores represent the extent and intensity of land-use pressure from each sub catchment within the Study Area

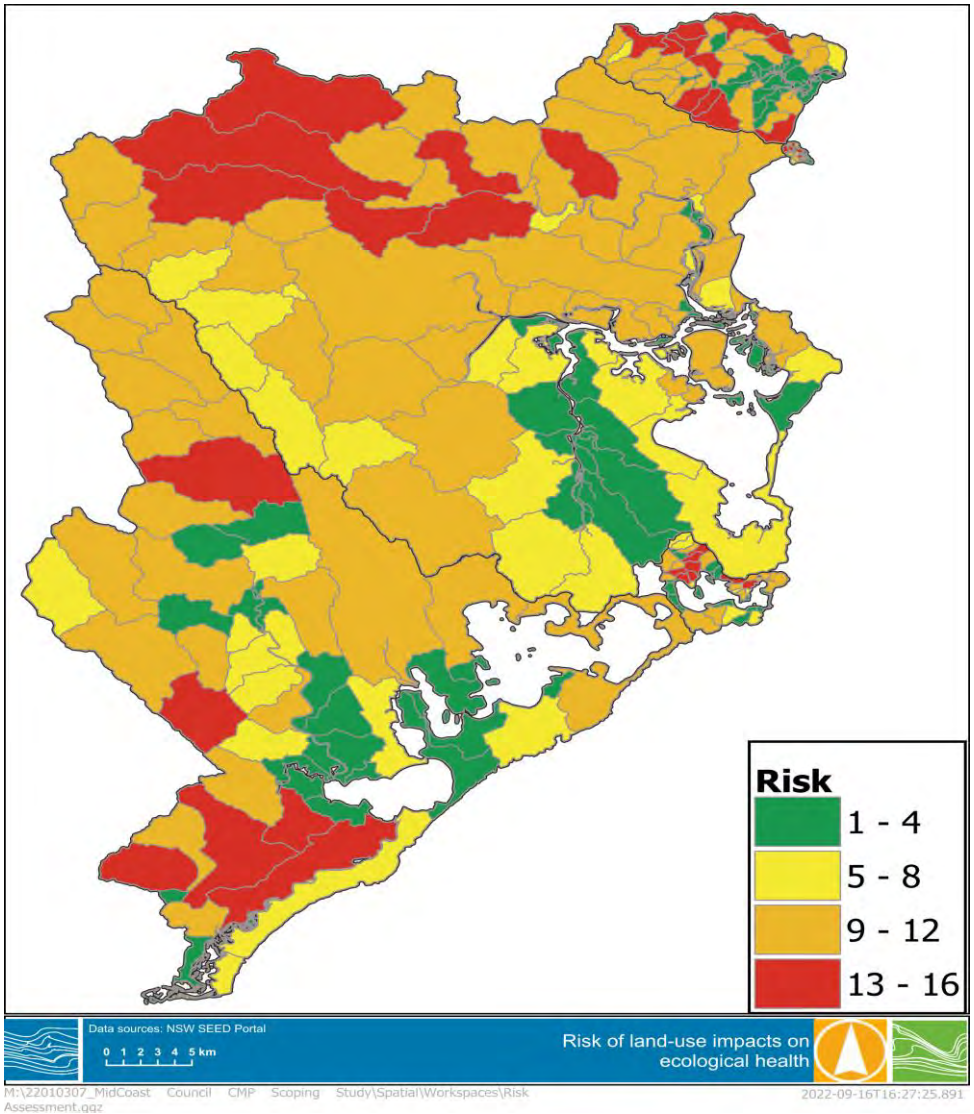

Figure 4-11 Risk of land use impacts within the study area catchment

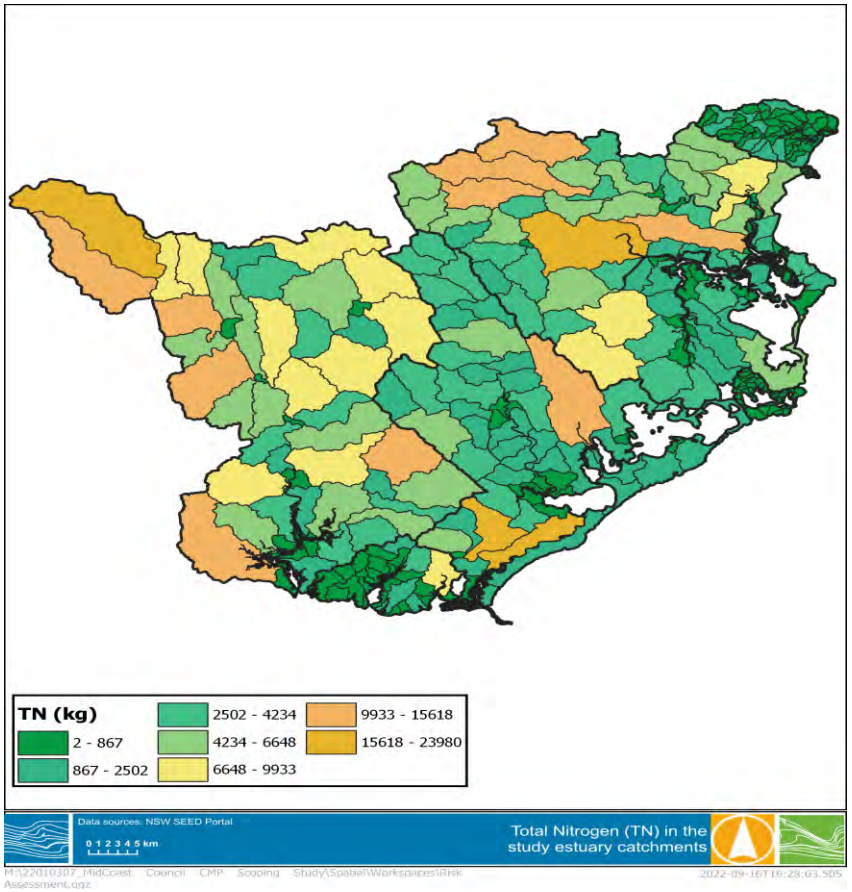

Figure 4-12 Total Nitrogen (TN) in the study area catchment

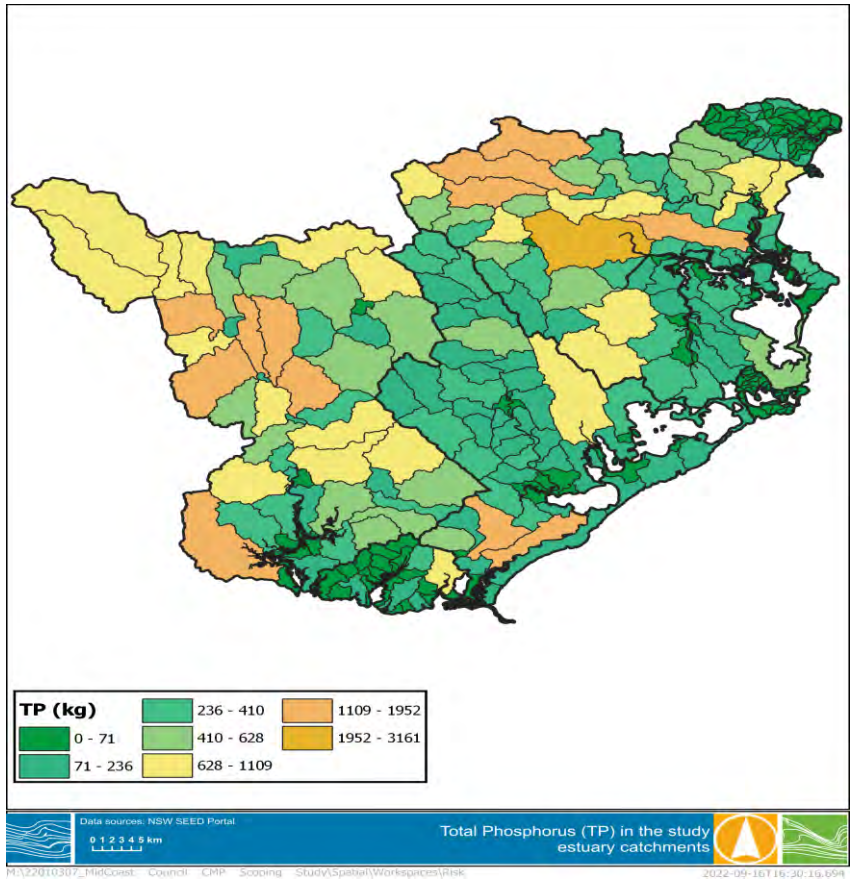

Figure 4-13 Total Phosphorus (TP) in the study area catchment

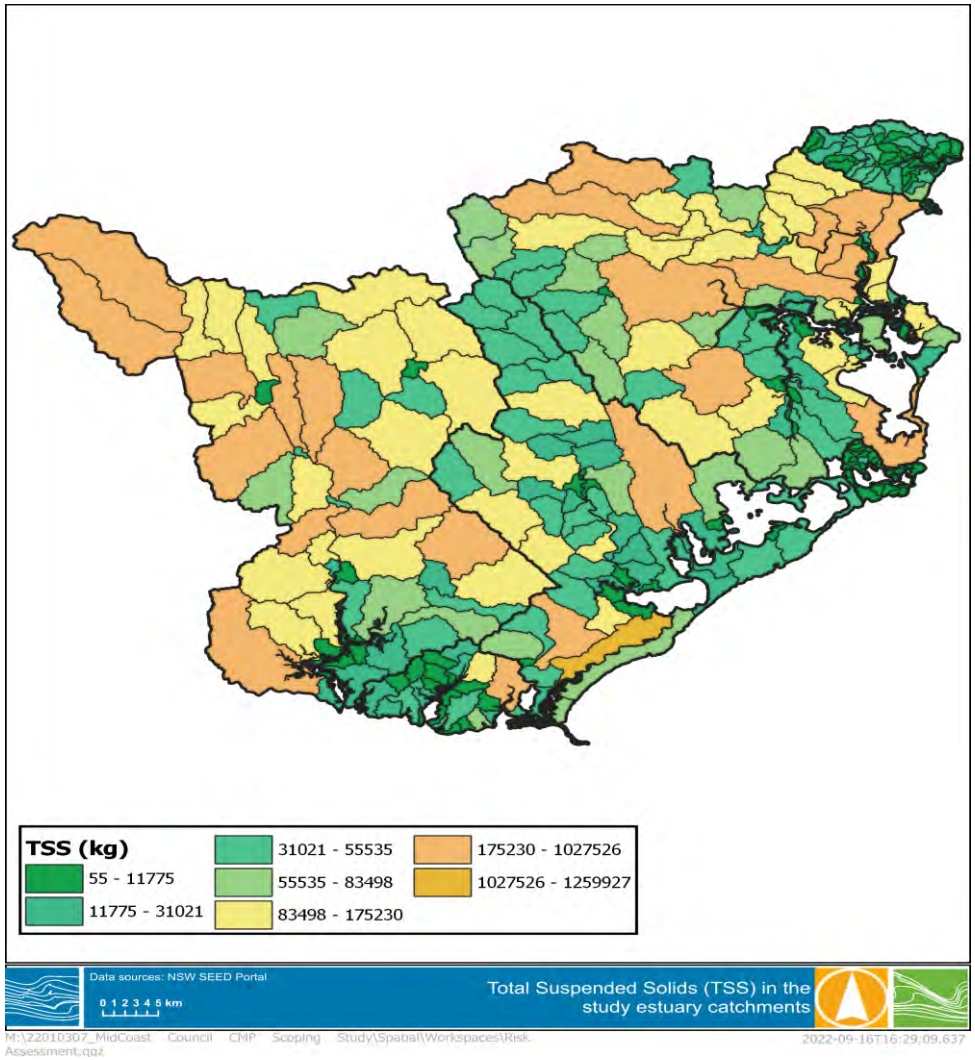

Figure 4-14 Total Suspended Solids (TSS) in the Study Area and its surrounding catchment

4.1.7 Coastal Zone Ecology and Biodiversity

The MidCoast southern estuaries comprises of complex biological systems and biodiversity hotspots that provide habitats to an abundance of flora and fauna.

Khappinghat Creek

Khappinghat Creek estuary is a large, undeveloped wetland and a naturally opening and closing estuarine system (ICOLL). Allard Creek, Magpie Creek, Muddy Creek, Moor Creek, Koorainghat Creek, Duckhole Gully and Saltwater Gully are tributaries of Khappinghat Creek which together form a system of waterways which support areas of rainforest, mangroves, salt flats, sedge and rush-dominated wetlands.

Flora

Khappinghat Creek and its tributaries are surrounded by forested wetlands which include swamp sclerophyll forests dominated by swamp mahogany (*E. robusta*), swamp oak (*Casuarina glauca*), red mahogany (*E.resinifera*) and the paperbark trees (*Melaleuca nodosa, M. sieberi)* and broad-leaved paperbark (*M. quinquenervia*).

The saltmarsh ecosystems include areas of sedges, rushes and tussock grasslands dominated by bare twig-rush (*Baumea juncea*), sea rush (*Juncus kraussii*), common reed (*Phragmites australis*), samphire (*Sarcocornia quinqueflora subsp. quinqueflora*) and marine couch (*Sporobolus virginicus*). The threatened plants species within the catchment include dwarf heath casuarina (*Allocasuarina defungens*), magenta lilly pilly (*Syzygium paniculatum*) and white-flowered wax plant (*Cynanchum elegans*).

The wetlands within Khappinghat estuary also include freshwater wetlands, swamp sclerophyll forest and river-flat eucalypt forest on its coastal floodplains and these are threatened ecological communities under the BC Act. These areas act as pollutant filters contributing to the water quality of creeks draining surrounding rural and rural residential areas.

Fauna

The flora around the catchments supports snakes, lizards, bandicoots, antechinus, wallabies, possums, gliders, forest birds and bats. Species of significance include koala (*Phascolarctos cinereus*), brush-tailed phascogale (*Phascogale tapoatafa*), common planigale (*Planigale maculata*), yellow-bellied glider (*Petaurus australis*) and the threatened squirrel glider (*Petaurus norfolcensis*).

Estuarine and freshwater habitats in Khappinghat Creek and its tributaries also provide nesting sites for wading birds and habitat for a range of amphibians, reptiles and mammals such as platypus (*Ornithorhynchus anatinus*). Many species of fish lay their eggs and develop through their larval and juvenile stages in these areas where abundant invertebrates such as crustaceans, molluscs and insects occur. The fish nurseries in turn support a range of waterbirds including the threatened, black-necked stork (*Ephippiorhynchus asiaticus*).

Key threats to native animal species include introduced species, erosion, stream degradation, habitat fragmentation and inappropriate human activities. Significant species considered threatened in the area include, black-necked stork (*Ephippiorhynchus asiaticus*), brush-tailed phascogale (*Phascogale tapoatafa*), common blossom-bat (*Syconycteris australis*), common planigale (*Planigale maculate*), flesh-footed shearwater (*Ardenna carneipes*), glossy black-cockatoo (*Calyptorhynchus lathami*), grey-headed flying-fox (*Pteropus poliocephalus*), koala (*Phascolarctos cinereus*), little tern (*Sterna albifrons*), eastern osprey (*Pandion cristatus*), pied oystercatcher (*Haematopus longirostris*), powerful owl (*Ninox strenua*), square-tailed kite (*Lophoictinia isura*), squirrel glider (*Petaurus norfolcensis*), wompoo fruit-dove (*Ptilinopus magnificus*) and yellow-bellied glider (*Petaurus australis*).

Black Head Lagoon

Whilst Black Head Lagoon is a relatively small and shallow ICOLL – it supports an extremely variable habitat system. The vegetations types surrounding the lagoon include she oak, paperbark and the grey mangroves. The foreshore of Black Head Lagoon has Norfolk Island pines which is an introduced species.

The only two species of flora listed as threatened are white flowered wax plant (*Cynanchum elegans*), rainforest cassia (*Senna accltms*). The vegetation within the estuary provides vital habitat for birds, crustaceans, macrofauna, and meiobenthos, which in turn are food for juvenile fishes. However, has been a significant reduction in species diversity with the introduction of an exotic fish species *Gambusla holbrooki*. This species thrives in poor water quality water and abundance of algae. Once introduced there is no specific methods to control the spread of this species.

The following threatened species are identified within the area square tailed kite (*Lophoictima isura*), glossy black cockatoo (*Calyptorhynchus lathami*), sooty oystercatcher (*Haematopus fuliginosus*), little tern (*Strena albifrons*), grass owl (*Tyto capensis*), masked owl (*Tyto novaehollandiae*), pled oystercatcher (*Haematopus longirostris*), black necked stork (*Ephippiorhynchus asiaticus*), osprey (*Pandion haliaetus*), white tern (*Gygis alba*), powerful owl (*Ninox strenua*), koala (*Phascolarctos cinerus*), brush-tailed phascogale (*Phascogale tapoatafa*), squirrel gilder (*Petaurus norfolcensis*), grey headed flying fox (*Pteropus poliocephalus*), common blossom bat (*Syconcyteris australis*), little bentwing - bat (*Miniopeterus australis*), and eastern bentwing - bat (*Schreibersii oceanensis*).

Wallis Lake Estuary Catchment

Flora

This system hosts a variety of unique landscapes, vegetation, and extremely high biodiversity of national importance. The estuary itself is listed as a “Nationally important wetland”. Cabbage tree palms and littoral rainforest are a distinctive feature, which line parts of the shoreline and areas of some of the estuarine islands of the Wallis Lake.

A number of areas within the Wallis Lake Catchment are also classified under CM SEPP Coastal Wetlands, and the major habitats of Wallis Lake consist of seagrass and macrophyte beds, intertidal sand and mud flats, rocky habitat, sponge gardens, islands and coffee rock. The vegetated marine habitats in the lake are predominantly seagrass, saltmarsh and mangroves.

Several other studies have investigated the ecological health and biodiversity of this area some of which are:

- Summary of Ecological Information for the Wallis Lake Potential RAMSAR Site (Fiebig, Suzanne, 2010)
- Wallis Lake Estuary and Catchment Management Plan (Great Lakes Council, 2014).
- Wallis Lake Seagrass Depth Range Sampling Survey Results June 2017 (NSW, OEH, 2017)
- Benthic Nutrient Fluxes in Wallis Lake, NSW (Smith, 2003).
- Macrophytes, fishes and invertebrates of Wallis Lake, New South Wales (Glasby, 2010).

Seagrass: The estuary/lake contains the largest area of seagrass in NSW, comprising 35% of the state’s total seagrass habitat - which is estimated to be 3,190 hectares (Great Lakes Council, 2014). Five species of seagrass are recorded in the catchment, *Zostera mulleri, Posidonia australis, Ruppia megacarpa Halophila ovalis* and *Halodule tridentata*. Wallis Lake represents the most northerly extent of *Posidonia australis,* in NSW while *Halodule tridentata* is exclusively recorded only within this estuary and was sighted for the first time in 2010 in NSW. These seagrass meadows are also pivotal to supporting Wallis Lake’s extensive recreational and commercial fishing industry. The connection to healthy seagrass meadows and sustainable fisheries in recognised in the *Fisheries Management Act 1994* (FM Act) and the NSW Department of Primary Industry’s (DPI) Policy and Guidelines for fish habitat conservation and management (DPI, 2013).

Saltmarsh: Saltmarsh vegetation is important coastal estuary habitat, and Wallis Lake has the second largest representation of saltmarsh in the state after Port Stephens. This vegetation type is under rapid decline in NSW. Changes in hydrology due to dredging of channels and the training of the entrance of the lake has significantly impacted the saltmarsh habitats which has indirectly allowed mangrove expansion.

Mangroves: The north shoreline of the lake is primarily occupied by mangroves and some patchy occurrence is also seen in the southern basin, in general mangroves and saltmarshes border most of the shoreline.

Terrestrial Vegetation: It is estimated that over 44% of the Pre-1750 Wallis Lake catchment vegetation has been cleared for agricultural, urban and infrastructure development. Its vegetation ranges from lowland wetland ecosystems to dry and wet sclerophyll forests. Across the system there are 51 different vegetation communities, of which 32 are classified as being of 'high conservation value'. Eight endangered ecological communities are also found in this catchment (Great Lakes Council, 2014), including:

- Freshwater Wetlands on coastal floodplain
- Littoral rainforest
- Lowland rainforest on floodplain
- Lowland rainforest
- Subtropical coastal floodplain forest
- Swamp oak floodplain forest
- Swamp sclerophyll forest on coastal floodplain
- River-flat Eucalypt forest.

Fauna

Wallis Lake and its catchment is home to nearly 50 threatened fauna species (Great Lakes Council, 2014) and is visited by 35 international migratory bird species. Some of the terrestrial threatened species include koala (*Phascolarctos cinereus*), squirrel glider (*Petaurus norfolcensis*) , spotted-tailed quoll (*Dasyurus maculatus*), brush-tailed Phascogale (*Phascogale tapoatafa*), greater broad-nosed bat (*Scoteanax rueppellii*), grey-headed flying fox (*Pteropus poliocephalus*), wallum froglet (*Crinia tinnula*), Stephen's banded snake (*Hoplocephalus stephensii*), osprey (*Pandion haliaetus*), pied oystercatcher (*Haematopus longirostris*), glossy black cockatoo (*Calyptorhynchus lathami*), masked owl (*Tyto novaehollandiae*) and black-necked stork (*Ephippiohynchus asiaticus*).

Another unique feature of the Wallis Lake system is the abundance and diversity of sponges and ascidians that have been recorded. Many of them are undescribed and new to science (Barnes, 2010). A survey by Barnes in 2017 (Peter Barnes, 2017) reported 12 sponge species, this number is twice the number of species recorded in any other lake or lagoon in NSW. Most species have their specific niches even within the Wallis Lake catchment, for example, *Dysidea* sp., *Raspaillia* sp., a species of *Haliclona* is restricted to Wallis Lake whereas *Chondrilla* c.f. *australiensis* and *Aplysilla* c.f. *sulphurea* are found in southern basin of Wallis Lake. These are unique communities which could be lost with increasing sediment load or loss of preferred habitats such as macroalgal and seagrass meadows.

Wallis Lake also houses both freshwater and marine fish species; the freshwater species occur occasionally at the southern end of the Lake. (Fiebig, Suzanne, 2010). Several turtle species are also found in the lake periodically, such as the green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricate*), which are also listed as Vulnerable species. The loggerhead turtle found within this area is listed as Endangered under the EPBC Act. Fish species such as black cod (*Epinephelus daemelii*), listed as Vulnerable under the FM Act and EPBC Act, and white seahorse (*Hippocampus whitei*) have also been reported in the catchment.

Pest species: Rusa deer (*Cervus timorensis*) has been reported in the Wallis catchment, generally seen around the Coomba Park. Feral deer are known to have a detrimental impact on native plants and have been listed as a key threatening process under the BC Act due to environmental degradation caused through grazing (DPIE, 2019).

Smiths Lake Catchment

Flora

Smiths Lake supports a diverse range of species and ecological communities, and thus has high ecological value to the region. The overall vegetation within the lake is in good condition, with a significant portion of the catchment located within the Wallingmat and Myall Lakes National Parks. Similar to Wallis Lake, the vegetated marine habitats in Smiths Lake are predominantly seagrass, saltmarshes and mangroves.

Seagrass: Seagrass covers approximately 2.23 km^2, restricted to the shallow parts of the lake where light can easily penetrate. Most seagrass occurs in the periphery of the lake, with dense seagrass meadows in Wamwarra Bay. The seagrass communities are mostly dominated by *Zostera* species but has *Ruppia* and *Halophila* present.

Saltmarsh: Saltmarsh communities fringe the lakes edges and are typically dominated by Sea Rush (*Juncus spp*.). Large saltmarsh areas also occur in Symes Bay and west of Horse Point, while tidal communities also occur in Wamwarra Bay and east of Tarwhine Point (BMT WBM, 2018).

The wetlands of Smiths Lake include herbaceous marshes and tree dominated swamps which are also classified as freshwater swamps or marsh in the coastal zone. They occur around the southern portion of Little Island and north-east of Symes Bay. The swamp forest that surrounds the lake include Paperbark, Swampy, Mahogany and Swamp Oak communities. Swamp forest areas located within Wanwarra Bay, Horse Point, Symes Bay, Big Island and Little Island are designated as CM SEPP Coastal Wetlands (BMT WBM, 2018).

Dune System: The dune vegetation on the south of the entrance channel, and across the entrance berm supports numerous endangered plants species, such as Sand Spurge (*Chamaesyce psammogeton*). The foreshore vegetation of the lake is dominated by species such as Blackbut, Grey Ironbark and Grey Gum.

Rocky shores: Another unique feature of Smiths Lake includes several sections of rocky shoreline. These habitats are mostly colonised by molluscs such as oysters and are highly influenced by the lake's entrance condition. The rocky inter-tidal shores are present on the north side of the Lake from Big Point to the east side of the township of Smiths Lake, on the south between Simons Point and Horse Point, and on the three islands (Big Island, Little Island, and Bull Island) within the Lake.

Fauna

The Smiths Lake habitats supports a large diversity and abundance of terrestrial faunal species. A study assessing the impacts of mining on amphibians at Smiths Lake (2017) reported 13 frog species in dune ponds and 12 frog species at the swamp areas. In particular, the Green and Golden Bell frog *(Litoria aurea)* and Wallum froglet *(Crinia tinnula)* are considered endangered and vulnerable, respectively (White, A, 2017).

Some of the other terrestrial threatened fauna species include koala (*Phascolarctos cinereus*), spotted-tailed quoll (*Dasyurus maculatus*), brush- tailed *Phascogale*(*Phascogale tapoatafa*), greater broad-nosed bat (*Scoteanax rueppellii*), grey-headed flying fox (*Pteropus poliocephalus*), Stephen's banded snake (*Hoplocephalus stephensii*), osprey (*Pandion haliaetus*), pied oystercatcher (*Haematopus longirostris*), glossy black cockatoo (*Calyptorhynchus lathami*), black-necked stork (*Ephippiohynchus asiaticus*), little bentwing bat (*Miniopterus australis*), yellow-bellied glider (*Petaurus australis*), eastern freetail-bat (*Mormopterus norfolkensis*), yellow-bellied sheath tail-bat (*Saccolaimus flaviventris*), eastern chestnut mouse (*Pseudomys gracilicaudatus*), little lorikeet (*Glossopsitta pusilla*) and powerful owl (*Ninox strenua*).

Aquatic fauna: The lake itself is an important fish breeding and nursery ground and has recorded up to 78 fish species (Robinson, 1983). Commercial fishing is also undertaken, the commonly targeted fish species includes the sea mullet, tarwhine, sand mullet and yellowfin bream. Spawning and recruitment of fish species is dependent on the status of the lakes entrance which may limit the distribution and abundance of fish population.

Sponges and jelly fish also inhabit the lake.The most common sponge species found are *Suberites cf diversicolor*, *Dysidea sp* and *Tetilla sp*. Periodic blooms coupled with typically patchy distributions among sites and habitats suggest there may be a number of abiotic and biotic processes driving these complex changes. (BMT 2018). Jelly fishes are top-down predators in the marine food chain and their increased numbers can initiate changes in trophic levels and may sometimes favour algal blooms.

Pest animals: Other common issues impacting the two systems (Wallis & Smiths Lake) include feral animals (such as foxes) which threaten the native wildlife. Exotic flora species include weeds such as, Asparagus, Bitou bush, and Lantana. These issues are being addressed through the Council's weed management program.

Myall Lakes Catchment

In 1999, the Myall Lakes were designated as a Wetland of International Importance under the Ramsar Convention and are protected by conservation reserves managed by the NSW Government. The Ramsar site's large area of 44,612 ha supports a rich biodiversity, containing a range of undisturbed terrestrial and wetland vegetation communities with a large number of plant and animal species. It consists of Myall Lakes National Park, Little Broughton Island Nature Reserve, Corrie Island Nature Reserve, and part of Gir-um-bit National Park. The estuarine and brackish waters and the beaches and intertidal areas in the site are within Port Stephens–Great Lakes Marine Park. The lake system drains into a catchment of 780 km^2 and holds a large volume of runoff and groundwater, and slowly releases this water into Port Stephens via the lower Myall River.

The lake comprises a mosaic of natural wetlands ranging from fresh to brackish and estuarine waters within a relatively unmodified coastal lake system unique in NSW. Its wetlands include brackish waters, fringing swamps, freshwater swamps, mangroves, saltmarshes, riverine ecosystems and rocky marine shores and beaches, and are surrounded by a near-natural terrestrial ecosystem. The Myall Lakes support the only known occurrence in Australia of *gyttja* (a green–brown organic rich sediment derived from the decomposition of charophytes, macrophytes and cyanobacterial algae) and is believed to be important in structuring and maintaining the submerged aquatic vegetation of the lake system.

Seagrasses: Species such as *Zostera capricornia*, *Posidonia australis* and *Halophila* species are found in the estuarine parts of the lower Myall River, Corrie Island and Fame Cove, and occasionally in Bombah Broadwater. Studies suggest that the seagrass areas in the Lower Myall River have decreased from 273 ha in 1985 to 2.6 ha in 2005 (Williams et al. 2006).

Mangroves and saltmarshes: These occur along the margins of the lower half of the Lower Myall River and around Corrie Island and in isolated patches all the way to the confluence with Bombah Broadwater at Tamboy (Williams et al. 2006). The two common NSW mangroves species (*Avicennia marina, Aegiceras corniculatum*). occur along the Lower Myall River and are important habitat for fish, crabs, birds and other animals. The mangroves also provide large amounts of organic matter which is eaten by many small aquatic animals.

Saltmarsh occurs along the banks of the lower half of the Lower Myall River, on Corrie Island. Crabs are common in saltmarsh communities and are a significant food source for bream and other carnivorous species. Some species, such as *Galaxias maculatus*, deposit their eggs in saltmarsh vegetation.

Freshwater macrophytes: The freshwater macrophyte and algal species found in the freshwater sections in Bombah Broadwater are dominated by *Ruppia megacarpa*, while mosaics of *R. megacarpa, Vallisneria gigantea* and *charophytes* flourish along the north. Typically, *Ruppia* spp. can be found in wide-ranging

salinities and there is approximately 710 ha of *Ruppia* in Bombah Broadwater and Two Mile Lake in 2001 (Dasey, 2004).

Freshwater fringing vegetation dominated by swamp she-oak (*Casuarina glauca*) and broad leaved paperbark (*Melaleuca quinquenervia*) grow along the Lower Myall River. The site also supports one threatened ecological community listed under the EPBC Act – littoral rainforest and coastal vine thickets of eastern Australia.

Overall, a total of 968 species of terrestrial and aquatic plants have been recorded within the catchment area and vegetation communities range from littoral rainforest to forest, heath, grassland, swamp, mangrove, seagrass, submerged aquatic vegetation and emergent freshwater vegetation. This Ramsar site is home to diverse faunal species which includes 298 birds, 58 mammals, 44 fishes, 37 reptiles and 29 amphibians.

The Myall Lakes Ramsar site provides habitat for 12 nationally or internationally threatened species among which five are wetland-dependent threatened species listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) or listed in the IUCN Red List of Threatened Species. These threatened species are the Australasian bittern (*Botaurus poiciloptilus*), Freycinet's frog (*Litoria freycineti*), green and golden bell frog (*Litoria aurea*), green-thighed frog (*Litoria brevipalmata*) and stuttering frog (*Mixophyes balbus*). Other threatened species include Gould's petrel (*Pterodroma leucoptera leucoptera*), grey-headed flying-fox (*Pteropus poliocephalus*), spotted-tailed quoll (*Dasyurus maculatus*), swift parrot (*Lathamus discolor*), Guthrie's grevillea (*Grevillea guthrieana*), magenta lilly pilly (*Syzygium paniculatum*) and black-eyed Susan (*Tetratheca juncea*).

Northern Foreshore of Port Stephens and the Karuah River

The Karuah River has a catchment area of over 500 km^2. Although significant sections of intact riparian vegetation are present in the Karuah River, part of the estuary, their characteristics are less well documented compared to the other three estuaries. The following number of threatened species are listed within the Karuah catchment, which was recorded in the Karuah River Catchment Management plan (2015)

- 3 endangered populations
- 12 endangered ecological communities
- 32 threatened plants
- 28 threatened mammals (15 terrestrial / arboreal species, 13 bats)
- 6 threatened frogs
- 1 threatened reptile (excluding marine turtles)
- 45 threatened birds (excluding oceanic species).

The largest areas of intact native vegetation mostly occur in the less developed and more inaccessible steep slopes of the catchment. The majority of the Karuah River (including Swan Island, Wirrung Island) foreshore is mapped as CM SEPP Coastal Wetlands. The seagrass habitats are almost non-existent, with few seagrass habitat patches recorded on the eastern end of the Karuah River. Isolated seagrass patches have been seen around Wirrung Island and also on the eastern foreshores of Swan Island. An 80% decline in seagrass habitats was reported in the in Karuah River Catchment Management Plan 2015.

Wetlands within the Karuah catchment includes Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest, while saltmarsh and mangroves habitats dominate along the length of the river including on Wirrung and Swan Island.

Invasive species: Weeds are a widespread problem in the Karuah catchment and includes weeds of National Significance (WoNS) such as include Madeira Vine, Lantana, Alligator Weed, Cats Claw Creeper and Blackberry. Other noxious weeds in the catchment which are Giant Parramatta Grass, Privet (small and broad

leaf varieties), Camphor Laurel, Green Cestrum, St John's Wort, Fireweed, Coolatai Grass (giant & dwarf), Noogoora Burr, Crofton Weed, Bathurst Burr and Willow.

Within the Karuah River catchment, some 15 different introduced mammal species and 8 species of introduced birds are recorded. No cane toad populations are known or expected at the present time, but the region supports a climate that is suitable to this invading species. Asian house geckoes occur in association with human settlements, but their ecological effects is not yet understood.. Feral species such as feral deer, foxes, feral cats and rabbits are also of great concern as predators of native biodiversity. These could have significant impacts on biodiversity as modifiers of natural environments and as competitors of native species and catchment values.

The MidCoast Biodiversity Framework (MidCoast Council, 2020) identifies management actions to enhance and maintain biodiversity across the LGA, and these actions should be considered during development of this CMP. The CMP should not only consider habitats and species that are known to occur but also identify opportunities to support both marine and terrestrial species that could potentially utilise the study area.

4.1.8 Climate Change

Climate change will have a long term and lasting impact on the welfare of NSW (Adapt NSW, 2019). The study area estuaries will experience broader impacts, as well as specific local impacts, many of which are inter-related. These include:

- **Mean sea level rise:** Rising sea levels will pose a serious risk to coastal communities due to inundation and erosion. Between 1993 and 2009, the rate of global sea-level rise was estimated to be 3.2 ± 0.4 mm/year (Church & White, 2011). The IPCC Sixth Assessment Report (6AR) (IPCC, 2021) outlines regional sea level rise (SLR) projections for a range of future emissions scenarios, and predicts a likely sea-level rise of:
  - between 0.21 m and 1.06 m by 2100, and
  - between 0.28 m and 1.95 m by 2150.

  As sea levels rise, built infrastructure may be potentially at risk, including drainage pathways, abutments, and adjoining roadways. Undeveloped shorelines may be equally vulnerable, with potential significant ecological implications (Glamore, Rayner, & Rahman, 2016).
- **Tidal inundation:** As sea-level rise increases, it is expected that the frequency and severity of tidal inundation (also referred to as “sunny day flooding”) will increase over time. This may lead to the progressive drowning of intertidal environments and freshwater habitats and increase the rate of landward displacement of estuarine shorelines and riparian ecosystems.
- **Estuarine flooding:** With warmer weather, storms and rainfall events are predicted to become increasingly intense in both the near and far future (IPCC, 2021). Combined with sea level rise, this will have major implications for the severity of flooding in the estuaries. Future impacts of climate change on estuaries depend on a number of factors including changes to rainfall, catchment infiltration, and conveyance of runoff, in addition to oceanic changes including regional tidal plane and storm surge changes. Extreme flooding can occur when there is coincident catchment flooding and elevated ocean levels (Glamore, Rayner, & Rahman, 2016). Estuarine water levels can also be impacted by changes to their entrance morphodynamics.
- **Estuarine hydrodynamics:** The resultant changes to tidal hydrodynamics from sea-level rise are likely to influence the water quality and mixing processes of estuaries. Sea-level rise will likely propagate tides and saline water further upstream when the entrance is open, resulting in an increase in the extent of saltwater intrusion. Increased salinity may impact inland soils, freshwater and groundwater resources and nutrient retention (Glamore, Rayner, & Rahman, 2016). Changes in tidal prism and tidal velocities will also increase the susceptibility of the estuarine foreshores to erosion and influence water quality and geomorphology. Furthermore, variations in rainfall patterns are likely to have a far-reaching impact on the

estuary systems, as freshwater flow is a large source of physical variability in the system. Sea-level rise may also lead to a number of changes to the physical process of estuaries, such as causing increased coastal erosion, permanent submergence in some areas, changes to the tidal prism, and the landward displacement of shorelines and estuarine habitats. This can also result in 'coastal squeeze' where built infrastructure prevents the landward movement of estuarine habitats, and their extent reduces as sea level rises (Australian Government Department of Climate Change, 2009).

- **Estuarine water chemistry**: In addition to sea level rise, climate change is expected to result in changes to the water quality (temperature, salinity, turbidity, suspended solids) and chemistry (oxygen, nutrients, pH and alkalinity, Chlorophyll-a) of coastal and estuarine systems. This includes ocean acidification and the impacts of warmer oceans on soft coral and fisheries (Adapt NSW, 2019).
- **Estuarine water temperatures:** A recent study has found that estuaries along the NSW coast are warming very rapidly, with average temperatures increasing more than 2 degrees over the past 12 years, which has been accompanied by acidification (Elliot Scanes, 2020). Small coastal estuaries are acidifying and warming the most rapidly compared to other estuary types. As the study area lies at the boundary between temperate and tropical habitats, the region is also expected to experience a tropicalisation of both marine and coastal environments, as the extent of flora and fauna extends south with the warming climate.
- **Biodiversity:** Flora and fauna diversity can be impacted by increasing air and ocean temperatures, rising sea level, change in ocean chemistry (i.e., due to ocean acidification), and decreasing water quality. In particular, coastal wetlands are particularly sensitive to climate change. These systems are usually unable to migrate inland as the shoreline recedes under sea level rise and are subject to threats caused by changes in the hydrologic and climate regimes – see Figure 4-15.
- **Heatwaves and Bushfires:** For humans, extreme heat is a major threat; heatwaves have been responsible for more deaths in Australia than any other natural hazard (Adapt NSW, 2019). As the climate becomes warmer and drier, there is an increased bushfire risk as well. By 2050, it is projected that extreme fire danger days in south-eastern Australia may occur 5 to 65percent more frequently compared to present (Adapt NSW, 2019). Increased heat along with altered rainfall and drought regimes may also lead to changes in water body salinity, freshwater availability and water quality.

Figure 4-15 SLR and habitat creep (Source: AGDCC, 2009)

A summary of projected climate change impacts as supplied by NSW Adapt is provided in Figure 4-16.

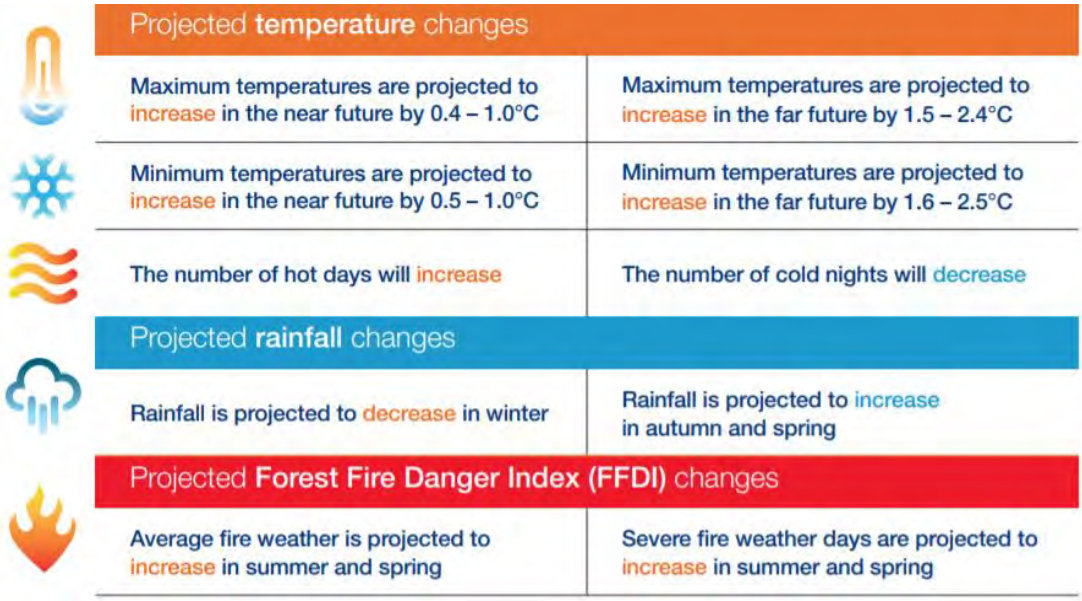

Figure 4-16 Projected Climate Change impacts in NSW (Source: NSWADAPT, 2019)

4.2 Governance Context

One of the objectives of the CMP is to facilitate the integration of management responsibilities across the study area. In order to develop a robust CMP that achieves its intended objectives now and into the future, it will be necessary to have an in-depth understanding of historical estuary management arrangements for the MidCoast estuaries, including the roles and responsibilities of the various agencies managing the different areas of the system.

The current governance of the system is multi-layered, with the catchments, foreshores, and waterways of the study area (and associated assets) owned and managed by a number of stakeholders across multiple levels of government. Maps depicting land tenure across the study area are provided in Figure 4-17 and Figure 4-18 – as per data sourced from the NSW Government Spatial Services Portal (NSW Government, 2021).

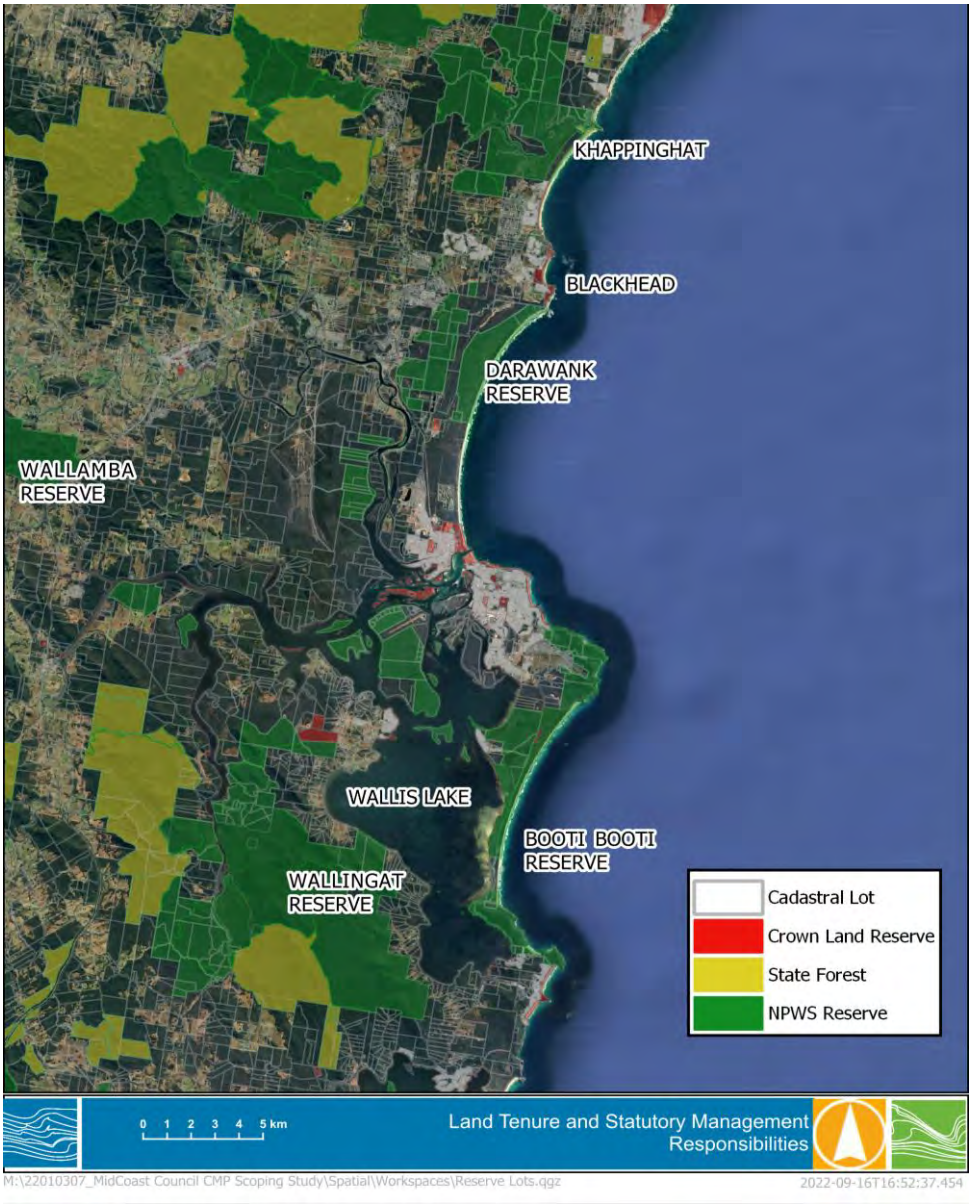

Figure 4-17 Land Tenure and Statutory Management responsibilities – Wallis & Smiths Lake

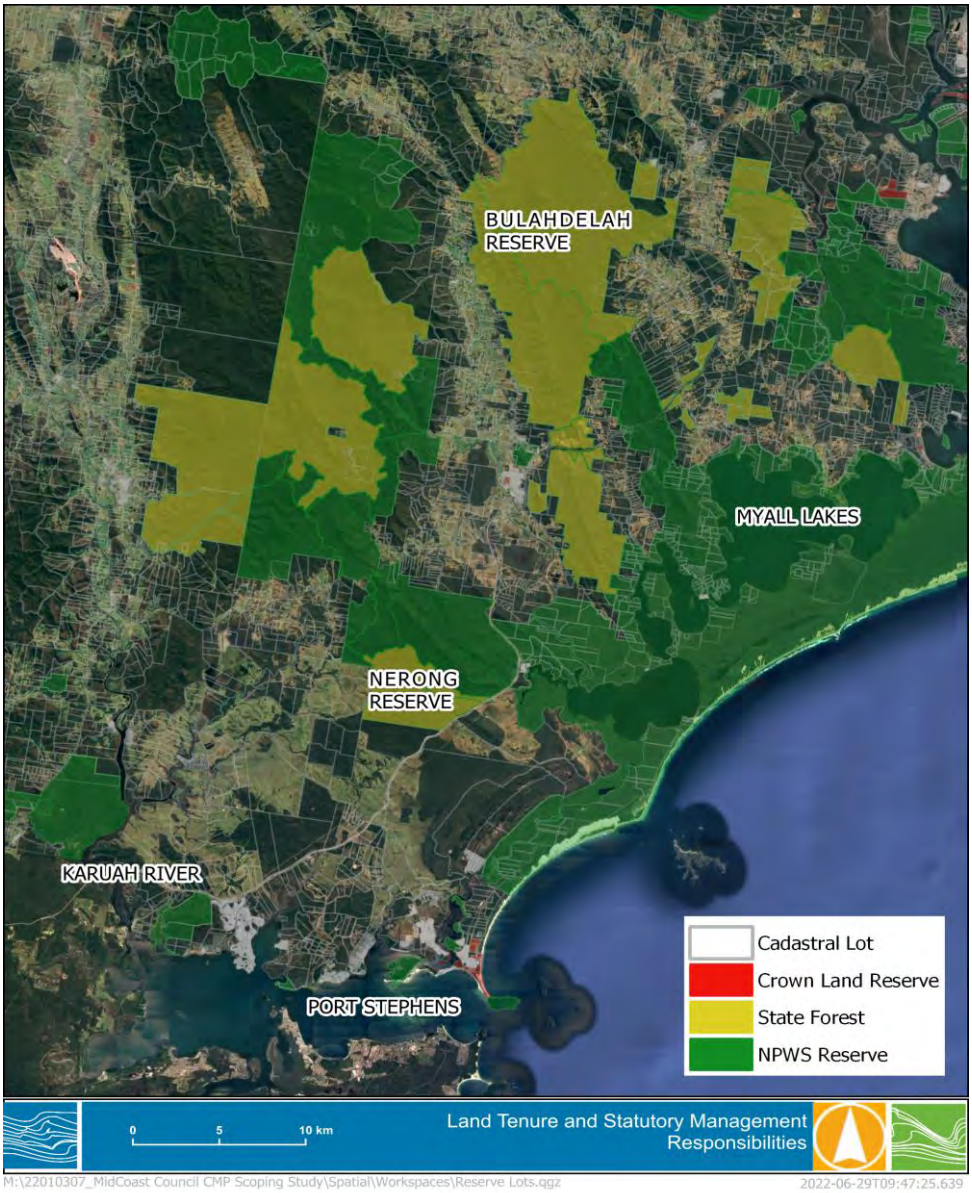

Figure 4-18 Land Tenure and Statutory Management Responsibility – Myall Lakes and Northern Foreshore of Port Stephens

4.2.1 Local Government

MidCoast Council has a central role in managing the waterways, foreshore and catchment of the study area estuaries. Council is responsible for preparation of a suite of CMPs that set out the long-term strategy for management of the coastal zone in its LGA.

An overview (see Table 4-9) of the range of council roles and responsibilities as they relate to the CMP is provided in below. Council responsibilities generally relate to management of catchment and estuarine issues, coastal zone land and assets, and strategic planning.

Table 4-9 Overview of Roles and Responsibilities of Council Across the Study Area

Issue Management	Land and Asset Management	Planning
▪ Coastal, estuary and waterway management ▪ Water quality monitoring and research ▪ Floodplain and flood risk management ▪ Vegetation protection and management ▪ Fauna protection and conservation ▪ Catchment management ▪ Community events ▪ Community consultation, engagement and education ▪ Cultural heritage preservation ▪ Recreational use of the estuaries and waterways ▪ Compliance and education activities (environmental and development) ▪ Bushfire planning and management	▪ Coastal and estuary infrastructure ▪ Stormwater and drainage infrastructure ▪ Road, traffic and parking infrastructure ▪ Open space and community assets ▪ Management of beaches and beach access ▪ Management of foreshore parks and access (including waterway access) ▪ Management of bushland reserve ▪ Management of WWTPs	▪ Strategic Planning - including implementation of regional strategies, development of Community Strategic Plans (CSP's) and Local Strategic Planning Statements (LSPS) and other strategies ▪ Development and implementation of planning controls (including LEPs and DCP's) ▪ Implementation of IP&R framework ▪ Development and implementation of CMP actions assigned to Council

Council is largely responsible for the management of estuarine and catchment assets that include estuary infrastructure (i.e., boat ramps and seawalls), stormwater and drainage infrastructure, open space assets and foreshore and estuary access points.

Council also manages a range of issues across the study area including, cultural heritage, community events, recreational use of the estuaries and foreshore, estuary and floodplain management, and flora and fauna protection and conservation. Council also undertakes water quality monitoring, as described in Section 4.1.6.

Council is also responsible for development planning and controls across the LGA. The objective of their development planning and controls is to achieve development that is consistent with the social, economic and environmental values of the estuaries and their catchments - and to manage the cumulative impact of development in a sustainable manner.

Council has established a number of groups involved in coast and estuary management, including reference groups, technical working groups and committees. For example, there is the Manning River Estuary Coastal Management Program Reference Group and the Old Bar - Manning Point Coastal Management Program Reference Group. These groups focus on specific coastal and estuary risks including asset protection, water quality and floodplain drainage. They include members from Council, DPE, Local Land Services, and NSW Maritime.

4.2.2 State Government

There are over fifteen (15) state government agencies with management roles and responsibilities across the study area that are relevant to the CMP. These agencies are spread across four (4) separate government departments (or clusters). These agencies and their position within the wider NSW state government

organisational structure are depicted in Figure 4-19. Some of these agencies have a land and asset management role, whilst others are issues based. A brief summary of the roles and responsibilities of the most relevant state government departments and agencies is provided below.

Many of the NSW government stakeholders for the CMP sit within the *NSW Department of Planning and Environment* (DPE) cluster. However, there are also a number of other state government agencies and organisations outside of this department that share management and planning responsibilities across the catchment system - including those from Transport for NSW (TfNSW), the Department of Regional NSW, and the Department of Community Services and Justice. A number of state-owned statutory corporations are also active across the study area.

The *NSW Coastal Council* provides independent expert advice to the Minister administering the CM Act on coastal planning and management issues, when requested by the Minister to do so. The Council was appointed under the CM Act, and replaced the NSW Coastal Panel and the Coastal Expert Panel. The Minister can request the NSW Coastal Council to audit a local council's implementation of its coastal management program to determine if it is being effectively implemented.

The Marine Estate Management Authority (MEMA) advises the NSW government on the management of the NSW marine estate, and coordinates policies and programs for maintaining and improving the marine environment. The Authority brings together the heads of the NSW government agencies with key marine estate responsibilities – including DPE (Planning, EES), DPI-Fisheries, and TfNSW (MEMA, 2019).

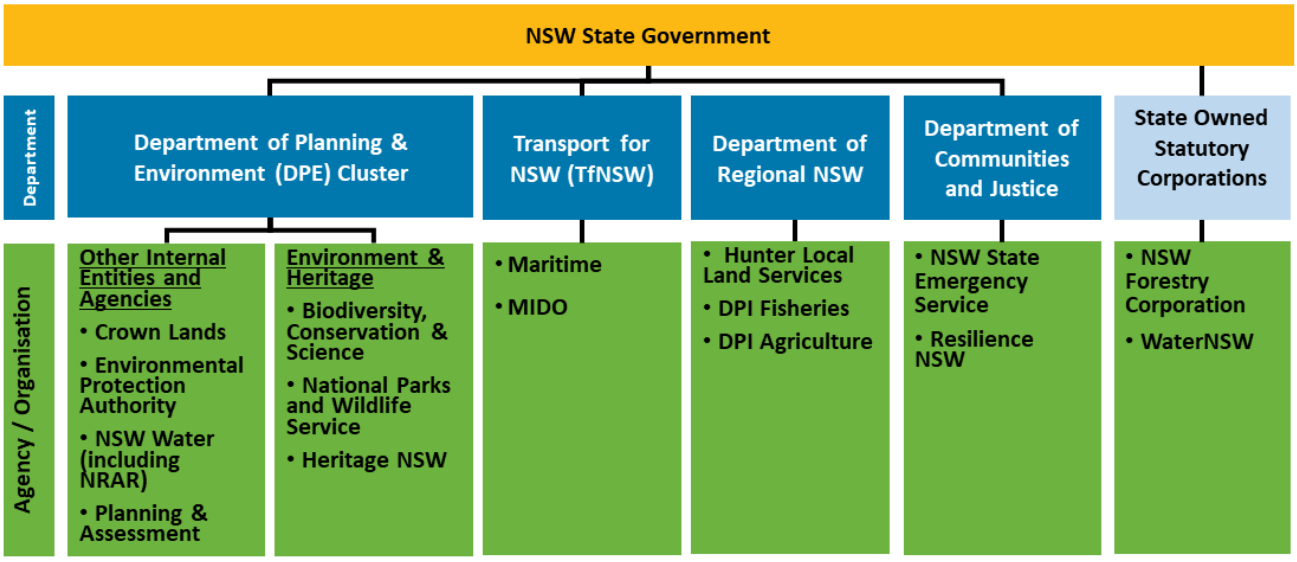

Figure 4-19 NSW State Government Agencies Relevant to the CMP

The NSW Department of Planning and Environment Cluster

Many of these CMP stakeholder organisations are positioned within DPE, and their responsibilities across the study area relate to land and asset management, issues management, and planning and assessment. Within DPE, the *Environment and Heritage Group* (E&H), has absorbed the responsibilities of the former Office of Environment and Heritage (OEH). DPE (E&H) is responsible for administering the CM Act and provides oversight of the State's coastal management program. Within the DPE (E&H) organisation structure, the *Biodiversity Conservation and Science Directorate* provides oversight in the development of each council's CMPs and provides data and technical advice as needed. It also administers the Coastal and Estuary Grants Program that provides funding for councils to prepare and implement their CMPs.

Within the DPE (E&H) organisation structure, lies the *NSW National Parks and Wildlife Service* (NPWS), which is responsible for management of the *National Parks and Wildlife Act 1974* and management of national parks and reserves across the study area, such as the Myall Lakes National Park. NPWS responsibilities across the areas involves a wide range of activities, including active conservation and habitat protection, fire management, management of tourism and visitation, research, and education. It is also responsible for management and protection of Aboriginal cultural heritage and European heritage across its land tenure.

DPE - *Crown Lands* (Crown Lands) is responsible for the administration and/ or management of Crown land under the *Crown Land Management Act 2016*. Crown land includes submerged Crown land, seabed and subsoil to three nautical miles from the coastline of NSW that is within the limits of the coastal waters of the State. Crown land includes much of the submerged land and intertidal areas (below mean high water mark) of the estuaries, as well as several foreshore reserves and beaches.

The NSW Environment Protection Authority (EPA) is the primary environmental regulator for New South Wales, and Council holds a number of environment protection licences (EPLs) issued by the NSW EPA under the *Protection of the Environment Operations Act 1997*. These licences generally relate to Wastewater Treatment Plants, Landfill Sites and Quarries, and Disused Landfill Sites Under Remediation. The storage, use and disposal of pesticides in NSW is administered and enforced by the EPA with oversight of the NSW Environment Minister.

The DPE *Planning and Assessment Group* (DPE – Planning) has a role to assess and determine proposals for development, including state significant projects, to ensure the need for new jobs is balanced with the needs of communities and the environment, and that major developments, infrastructure and industrial sites meet strict conditions. It also has a role in coastal policy and implementation, and Council may need to liaise with this group if it intends to amend any of the CM SEPP Mapping of Coastal Management Areas through a planning proposal.

The Department of Regional NSW

In April 2020, the NSW Government established the Department of Regional NSW. The department was formed to bring together the divisions of Primary Industries, Local Land Services, Resources and Geoscience to form a central agency dedicated to regional issues.

Department of Primary Industries - Fisheries (DPI-Fisheries) is responsible for administering the *Fisheries Management Act 1994* and ensure decisions made about land management and development avoids and minimises impacts on fisheries resources. Its responsibilities also include the licensing of recreational fishers, enforcement of bag limits, and permits for commercial fishing activities. It is responsible for threatened species conservation and marine vegetation protection (including mangroves, saltmarsh and seagrass) across the waterways of the study area. Fisheries also administer the *Marine Estate Management Act 2014* in coordination with the NSW Marine Estate Management Authority (MEMA). Fisheries is also responsible for the management of the Port Stephens-Great Lakes Marine Park, which extends from Cape Hawke near Forster south to Birubi Beach at the northern end of Stockton Beach and includes offshore waters to the 3 nautical mile limit of state waters and all estuarine waters of Port Stephens and the Karuah River, the Myall River, Myall and Smiths Lakes and all of their creeks and tributaries to the limit of tidal influence.

The Department of Primary Industries – Agriculture (DPI-Agriculture) is responsible for increasing the productivity and resilience of the agricultural sector in NSW. It does this through agricultural productivity research across livestock, plants and natural resource management areas, as well as providing education and training.

Hunter Region Local Land Services (LLS) was established under the *Local Land Services Act 2013* to provide agricultural production advice, biosecurity, natural resource management and emergency management functions cross the Hunter region (LLS, 2016). NCLLS engages in regional and sub-catchment natural resource management (NRM) planning, training and education for the community in areas such as farm

management practices, as well as environmental monitoring of horticultural practices (LLS, 2016). LLS also delivers grant and funding programs to support natural resource management and sustainable agriculture activities. The Hunter region extends from the MidCoast Council in the north to Lake Macquarie City Council in the south, Upper Hunter Shire Council in the west.

Transport for NSW

The Transport cluster comprises TfNSW and an extended network of other agencies. TfNSW sets the strategic direction for transport and works in partnership with government transport operating agencies and private service providers to deliver improved transport outcomes for the community and economy of NSW.

Maritime sits within TfNSW as the state's maritime safety regulator for commercial and recreational vessels and their operators. Maritime's role within TfNSW is to promote safe, responsible and sustainable use of waterways, including but not limited to the enforcement of safe on-water vessel practices, the administration of recreational vessel licenses and vessel registrations, and provision of guidance for safe navigation.

It is also responsible for the direct delivery of a number of maritime infrastructure projects as well as investment in many others across the state. Other responsibilities include property administration, policy development, strategic planning and infrastructure management related to commercial and recreational boating – including some of the boat ramps and public jetties, wharves and pontoons across the study area (noting that most boat ramps are generally owned and managed by councils).

The Maritime Infrastructure Delivery Office (MIDO) sits within Maritime and is a joint initiative between the former agencies of Roads and Maritime Services and the Department of Industry to improve the coordination and delivery of coastal and boating infrastructure programs and projects across NSW that support recreational boating, fishing, tourism and a range of other commercial activities. The MIDO is responsible for delivering key projects and programs including TfNSW's Boating Now Program, DPE's Coastal Infrastructure Program, Boating Access Dredging Program and a number of major projects including the La Perouse to Kurnell Ferry Wharf and Eden Safe Harbour projects.

NSW Department of Community Services and Justice

The NSW State Emergency Service major responsibilities are for provision of emergency and rescue during times of natural hazard emergencies and disasters - including flooding, storms (including storm tide and severe erosion events), and tsunami events.

Resilience NSW (formerly the NSW Office of Emergency Management) leads, coordinates and develops capability in the emergency management sector, and conducts state-wide welfare and recovery operations when disaster strikes (OEM, 2019).

4.2.3 Federal Government

Federal government roles and responsibilities are relatively minimal in the CMP. Across the study area, a major agency is the federal *Department of Agriculture, Fisheries and Forestry* (DAFF) which is responsible for development and implementation of national policies and programs to support agriculture, fisheries, and food industries and the productive management of rivers and water resources.

The Federal Government is also responsible for administering the *Environment Protection and Biodiversity Conservation Act, 1999* as it relates to various federally listed threated species and ecological communities occurring within the study area.

4.2.4 Non-governmental Organisations

There are a number of other non-governmental organisations (NGOs) that operate across the study area. These organisations include local aboriginal land councils, educational institutions, industry groups, landcare and bushcare groups, and community and resident groups and businesses.

The *Local Aboriginal Land Councils* (LALCs) acting across the study area have a degree of governance and interface with council, as well as the various State and Federal Government bodies. LALCs have a right to be informed and involved in the planning, protection and preservation of cultural sites and areas under the *NSW Aboriginal Land Rights Act 1983* on land within their boundaries. The LALCs aim to achieve long term economic and social solutions for the indigenous communities, and to conserve and maintain cultural and heritage land management. The Purfleet/Taree LALC covers the area north from Khappinghat Creek, the Forster LALC covers a geographical area between the coast and the Central Highlands, from Seal Rocks in the south to Hallidays Point in the north, and the Karuah LALC covers much of the Karuah catchment, between the Forster LALC to the north to Port Stephens in the south. The Worimi LALC is south of Karuah and covers Port Stephens.

MidCoast2Tops Landcare Connection is a volunteer organisation acting as the umbrella group for land care volunteers across the MidCoast LGA. MidCoast2Tops Landcare Connection incorporates three-member networks; Manning Landcare, Manning Coastcare Group and Karuah Great Lakes Landcare. They assist members and the general public with their natural resource management activities, and pursue funding assistance for projects, practical assistance, and education and training across the study area.

NSW Farmers is an association of farmers and stakeholders of the agricultural industry. It is a lobby group for the farming sector, advocating for farmers and rural communities at all levels of government and with industry stakeholders.

The University of Newcastle and University of New South Wales are also involved in a number of teaching and research projects focussing on the study area estuaries. They have worked with Council to share long-term data collected in the area and are a part of Council's Technical Working Group.

4.3 Policy Context

The legislation and policy governing management of study area is complex and includes acts and policies from all levels of government. A brief overview of the most relevant acts is provided herein for context.

4.3.1 Coastal Management Act 2016

The CM Act establishes the framework and sets forth the objectives for coastal management in New South Wales. The purpose of the CM Act is to manage the use and development of the coastal environment in an ecologically sustainable way, for the social, cultural and economic well-being of the people of New South Wales (DPIE, 2019a).

The CM Act defines the coastal zone, comprising 4 coastal management areas:

- Coastal wetlands and littoral rainforests area
- Coastal vulnerability area
- Coastal environment area
- Coastal use area.

The CM Act establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities.

4.3.2 State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP) updates and consolidates into one integrated policy a series of previously enforced SEPPs, including: SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan.

The CM SEPP streamlines coastal development assessment requirements, identifies development controls for consent authorities to apply to each coastal management area to achieve the objectives of the CM Act, and establishes the approval pathway for coastal protection works (DPIE, 2019).

State-wide mapping that accompanies the CM SEPP is available for the coastal wetlands and littoral rainforest area, the coastal environment area, and the coastal use area. The mapping of coastal vulnerability areas is undertaken as part of CMP development, based on either existing coastal hazard mapping, or mapping to be developed during Stage 2 of the CMP.

4.3.3 Marine Estate Management Act 2014

The *Marine Estate Management Act 2014* (MEM Act) forms part of the NSW Marine Estate Management Framework. The framework comprises statutory instruments, strategies, assessment, plans and policy settings, and is administered under the auspices of the Marine Estate Management Authority (MEMA).

The objective of the MEM Act is to provide for strategic and integrated management of the NSW marine estate, including the marine waters, coasts and estuaries. The MEM Act promotes a biologically diverse, healthy and productive marine estate, and facilitates the economic cultural, social and recreational use of the marine estate, scientific research, education and management of marine parks. The key legislative instruments under the MEM Act include:

- Marine Estate Management Regulation 2017; and
- Marine Estate Management (Management Rules) Regulation 1999.

As all four of the estuaries are located within the Port Stephens-Great Lakes Marine Park there are a number of special legislative protections and requirements that apply to the estuaries under the MEM Act and regulations. Under Section 56 of the MEM Act, for any development on land that is in the locality of a marine park, the consent authority must take into consideration the Act and potential impacts on the marine park.

Any development within marine parks, under Section 55 of the MEM Act (any development below the mean high-water mark) requires the Ministers consent. If the consent authority intends to grant consent to the carrying out of the development, it must obtain the concurrence of the relevant Ministers to the carrying out of the activity or the granting of approval

Furthermore, marine park legislative requirements require that certain activities require consent (in the form of a marine park permit), including:

- Any activity that contravenes the protection of animals, plants and habitat within a marine park zone. (Clause 1.11, 1.16, 1.19, 1.22);
- Commercial (Clause 1.32) or research activities (Clause 1.31); and
- Organised sporting, educational or recreational activities (Clause 1.34).

It should be noted that one of the objectives of the CM Act (and of the CMP) is to support the objectives of the MEM Act 2014.

4.3.4 Additional Legislation and Policies

As of mid-2019, the NSW government has been working towards developing a new State Environmental Planning Policy (SEPP) for the protection and management of the natural environment. The Draft consolidated Environment SEPP is intended to simplify the planning rules for across catchments, waterways and urban bushland. The SEPP will consolidate and supersede the following seven (7) existing SEPPs:

- State Environmental Planning Policy No. 19 – Bushland in Urban Areas
- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011
- State Environmental Planning Policy No. 50 – Canal Estate Development
- Greater Metropolitan Regional Environmental Plan No. 2 – Georges River Catchment
- Sydney Regional Environmental Plan No. 20 – Hawkesbury-Nepean River (No.2-1997)
- Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
- Willandra Lakes Regional Environmental Plan No. 1 – World Heritage Property.

Additionally, a new planning framework for primary production and rural development commenced on 28 February 2019. The SEPP (Primary Production and Rural Development) 2019 supports NSW's agricultural sector, and simplifies the NSW planning system by consolidating, updating and repealing provisions in five former agriculture-themed SEPPs. The table below provides an overview of the key legislation and policy relevant to the management of the study area.

Table 4-10 Relevant Legislation

Legislation	Abbrev.	Administered By	Summary
Commonwealth			
Environment Protection and Biodiversity Conservation Act 1999	EPB&C Act	Department of Environment and Energy	The Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. Commonwealth marine areas are matters of national environmental significance under the Act.
Native Title Act 1993	NT Act	Department of Attorney General Minister for Indigenous Affairs	The act establishes a framework for the protection and recognition of native title and enables DPE to enter into indigenous land-use agreements. The parts of the Native Title Act 1993 relating to native title representative bodies and prescribed bodies corporate are administered by the Minister for Indigenous Affairs.
State (NSW)			
Aboriginal Land Rights Act 1983	ALR Act	Minister for Aboriginal Affairs NSWALC DPE (Crown Lands)	The purpose of this Act is to provide land rights for Aboriginal persons in NSW, and to provide for representative Aboriginal Land Councils. The Act makes provision for claimable Crown lands and other dealings by Local Aboriginal Land Councils (LALC). It also provides for agreements to permit hunting, fishing and gathering by Aboriginal groups or persons. It is administered by the Minister for Aboriginal Affairs, but allocates roles, responsibilities and powers to The NSW Aboriginal Land Council (NSWALC) and DPE (Crown Lands). It should be noted that there may be a number of incomplete claims under the ALR Act that have been lodged on Crown land within the study area.
Biodiversity Conservation Act 2016	BC Act	DPE	The Act stipulates how development activities on land are regulated and how the impacts of these activities on the natural environment are managed. It is intended to conserve biological diversity and promote ecologically sustainable development.
Biosecurity Act	BIO Act	LLS	The Biosecurity Act 2015 came into effect on 1 July 2017. It aims to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants.
Coastal Management Act	CM Act	DPE (E&H)	The CM Act establishes the framework and sets forth the objectives for coastal management in New South Wales. The purpose of the CM Act is to manage the use and development of the coastal environment in an ecologically sustainable way, for the social, cultural and economic well-being of the people of New South Wales (DPIE, 2019a).
Crown Land Management Act 2016	CLM Act	DPE (Crown Lands)	The Act requires that environmental, social, cultural heritage and economic considerations to be taken into account in decision-making about Crown land.

Legislation	Abbrev.	Administered By	Summary
Environmental Planning & Assessment Act 1979	EP&A Act	DPE Council	The act requires relevant planning authorities to take into consideration the impacts to the environment (both natural and built) and the community of proposed development or land-use change.
Fisheries Management Act 1994	Fisheries Act	DPI-Fisheries	The objects of this Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.
Forestry Act 2012	Forestry Act	Forestry Corporation	The Act defines the objectives, functions and constitution of the Forestry Corporation.
Heritage Act 1977	Heritage Act	DPE (Environment)	The Act provides for the conservation of environmental heritage items in NSW. It is intended to promote understanding and conservation of the state's heritage and provide for identifying and registering items of state heritage significance. The Act is complemented by the Heritage Regulation 2012.
Local Government Act 1993	LG Act	DPE (Planning)	The Act provides the legal framework for the system of local government for New South Wales, and sets out the responsibilities and powers of councils, councillors and other persons and bodies that constitute the system of local government. DPIE administers Part 2A of Chapter 6 of the Act, which allows councils to make environmental upgrade agreements with development proponents. The Act is complemented by Local Government (General) Regulation 2005.
Local Land Service Act 2013	LLS Act	LLS	The objective of the Act is to guide the management and delivery of local land services in the social, economic and environmental interests of the State. The Local Land Service Act 2013 requires the development of regional strategies to set the vision, priorities and strategy for the delivery of local land services in each region. The act is also the main piece of legislation for managing and protecting native vegetation.
Marine Estate Management Act 2014	MEM Act	MEMA	The Marine Estate Management Act 2014 (MEM Act) forms part of the NSW Marine Estate Management Framework. The framework comprises statutory instruments, strategies, assessment, plans and policy settings, and is administered under the auspices of MEMA. The objective of the MEM Act is to provides for strategic and integrated management of the NSW marine estate, including the marine waters, coasts and estuaries.
Marine Safety Act 1998	MS Act	TfNSW	The purpose of the MS Act is to provide an effective framework for the enforcement of marine legislation, and is administered by TfNSW. The objects of the Act are to ensure the safe and responsible operation of vessels in ports and other waterways, so as to protect the safety and amenity of other users of those waters and the amenity of occupiers of adjoining land. It also aims to provide for the investigation of marine accidents and for appropriate action following any such investigation.

Legislation	Abbrev.	Administered By	Summary
National Parks and Wildlife Act 1974	NPW Act	DPE (NPWS)	The Act provides for the management of National Parks reserve land, including the conservation of nature, including habitat, ecosystems and heritage. It is the main piece of legislation for managing and protecting Aboriginal cultural heritage in NSW. The NPW Act is complemented by the National Parks and Wildlife Regulation 2009.
Natural Resources Access Regulator Act 2017	NRAR Act	DPE (NRAR)	The Act defines the objectives, functions and constitution of the NRAR.
Natural Resources Commission Act 2003	NRC Act	DPE (Planning)	The Act established The Natural Resources Commission - an independent body with broad investigating and reporting functions for the purposes of establishing a sound evidence basis for the properly informed management of natural resources in the social, economic and environmental interests of the State.
Protection of the Environment Operations Act 1997	POEO Act	DPE (EPA)	The key piece of environment protection legislation administered by the EPA. The object of the Act is to achieve the protection, restoration and enhancement of the quality of the NSW environment.
Rural Fires Act 1997	RF Act	NSW RFS Local Councils	The purpose of the is to facilitate the co-ordination of bush fire fighting and bush fire prevention throughout the State. It is intended to enhance the protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires.
State Emergency Service Act 1989	SES Act	Department of Community Services	The Act defines the functions on the NSW State Emergency Service.
Water Management Act 2000	WM Act	DPE (Industry) Water NSW	The object of the Act is the sustainable and integrated management of the state's water for the benefit of both present and future generations. The act is supported by the Water Management (General) Regulation 2018.
Water NSW Act 2014	Water Act	DPE (Industry) Water NSW	The object of the Act to ensure that declared catchment areas and water management works in such areas are managed and protected so as to promote water quality, the protection of public health and public safety, and the protection of the environment. The act is supported by the Water NSW Regulation 2013

4.4 Management and Planning Context

A number of coastal and estuary management plans guide management of the MidCoast southern estuaries. Furthermore, there exist several planning instruments relevant to the broader governance arrangements of study area. These include:

- National / Federal Plans;
- State Level Plans;
- Regional Level Plans; and
- Local Level Plans.

A brief overview of these plans is provided herein. A full list of relevant studies and plans is provided in Appendix B.

4.4.1 National / Federal Plans and Strategies

The National Water Quality Management Strategy (NWQMS) is a federal strategy to protect the nation's water resources through maintaining and improving water quality, while supporting dependent aquatic and terrestrial ecosystems, agricultural and urban communities, and industry (Australian Government, 2018). The purpose of the NWQMS is to develop a nationally coordinated framework (supported by all Australian governments) to facilitate water quality management. The objectives of the strategy are to ensure the productive and sustainable use of Australia's water resources, and to protect community values such as aquatic ecosystems. The CMP will need to ensure broad alignment with the objectives and guidelines of the NWQMS.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000) provide authoritative guidance on the management of water quality in Australia and New Zealand and provide a platform for consistent water quality management and planning across the nation. The National Water Quality Management Framework established as part of the guidelines sets out key requirements for long-term management strategies of riverine and estuarine water quality. The framework includes ten (10) steps that relate directly to water/sediment quality decisions and actions and expands on the approach described in the National Water Quality Management Strategy charter.

4.4.2 State Level Plans

The *NSW State Plan 2021* is a 10-year plan that establishes the vision for state planning and outlines the framework to achieve the state's economic, health, transport, infrastructure and the environmental goals. The overarching goals and objectives of the plan provide direction for the development and implementation of the various regional and local plans and strategies outlined in Section 4.4.3 and 4.4.4 respectively.

The NSW Marine Estate Management Strategy 2018-2028 (MEMS, 2018) provides an overarching, strategic approach to the coordination and management of the marine estate through to 2028. It sets the overarching framework for the NSW Government to coordinate management of the marine estate over the next decade in accordance with the objects of the MEM Act 2014 and the NSW Government's vision for the marine estate (MEMS, 2018). The Strategy responds to the priority threats to water quality, habitats and biodiversity of the State's coastal waters and estuaries that were identified in the NSW Marine Estate Threat and Risk Assessment (TARA) (BMT WBM, 2017). The management of priority threats is grouped into nine (9) management initiatives that summarise the objectives, benefits, threats, stressors and proposed management actions. These initiatives comprise:

- Improving water quality and reducing litter
- Delivering healthy coastal habitats with sustainable use and development
- Planning for climate change

- Protecting the Aboriginal cultural values of the marine estate
- Reducing impacts on threatened and protected species
- Ensuring sustainable fishing and aquaculture
- Enabling safe and sustainable boating
- Enhancing social, cultural and economic benefits
- Delivering effective governance

An implementation plan (developed by the Authority's member agencies in consultation with key stakeholders) articulates the management actions in more detail. Coastal Management Programs are one of the key delivery mechanisms for the NSW Marine Estate Management Strategy (MEMS).

Progress towards implementing the MEMS and delivering its vision is measured and reported through the *NSW Marine Integrated Monitoring Program* (MIMP). The MIMP sets out a high-level approach for assessing progress against outcomes that management actions are expected to collectively achieve. Indicators will be used to provide quantifiable metrics for tracking performance towards outcomes (Aither, 2019). It is intended to guide monitoring, evaluation and reporting activities over the life of the MEMS. As per Aither (2019), the MIMP has three key purposes to:

- Monitor the condition and trend of environmental assets and community benefits to inform a five-year health check;
- Evaluate the effectiveness of management initiatives and actions that aim to reduce priority threats and risks; and
- Fill knowledge gaps that were identified as part of the state-wide TARA process.

As part of the MIMP, an integrated monitoring and evaluation framework has been developed to assess the effectiveness of the Strategy in reducing priority threats and risks (point 2 above). This Framework was developed in collaboration with Marine Estate Management Authority agencies and the Marine Estate Expert Knowledge Panel (MEMA, 2019).

Recently, DPE has developed the *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (OEH, 2017). This framework presents a structured approach that decision-makers, such as councils and environmental regulators, can use to help manage the impact of land-use activities on the health of waterways in New South Wales. The framework brings together existing principles and guidelines recommended in the National Water Quality Management Strategy and allows decision-makers to determine management responses that meet waterway health outcomes - and reflect the community's environmental values and uses of waterways (OEH, 2017).

The NSW Water Quality and River Flow Objectives (NSW Government, 1999) are agreed high-level goals for surface water flow management in NSW. The objectives set out 12 aspects of flow considered critical for the protection or restoration of river health, ecology and biodiversity. The objectives were subject to extensive public consultation and endorsed by the NSW Government in 1999. The objectives consist of three parts, following the recommended approach in the NWQMS: environmental values and uses, their indicators and their guideline trigger values. The indicators and guideline trigger values are used to help assess whether a waterway will support a particular environmental value (OEH, 2017). These objectives are also complimented by the *Marine Water Quality Objectives* (DEC, 2005) which address coastal and marine waters and aim to simplify and streamline the consideration of water quality in coastal planning and management.

In November 2016, the NSW Government released the *NSW Climate Change Policy Framework*. It outlines the Government's role in reducing emissions, and helping NSW adapt and become more resilient to the impacts of climate change. The policy framework provides the strategic framework for NSW Government action

on climate change and sets two objectives: to achieve net-zero emissions by 2050, and to make NSW more resilient to a changing climate.

DPE - Crown Lands have recently released a 10-year vision for Crown land in NSW. The *Crown land 2031 – State Strategic Plan for Crown land* (Crown Lands, 2021) reflects Government and community aspirations to deliver social, environment and economic benefits from Crown land. The strategic plan includes the following agency priorities:

- Accelerating economic progress in regional and rural NSW;
- Realising Aboriginal land rights and native title;
- Protecting cultural heritage on Crown land;
- Protecting environmental assets, improving and expanding green space, and enhancing climate change resilience; and
- Strengthening and supporting community connections.

The NSW Maritime Infrastructure Plan 2019-2024 (MIP), released in December 2018, sets out a strategic and coordinated approach to prioritising and delivering maritime infrastructure in NSW. The Plan aims to deliver better outcomes for residents, businesses and visitors by facilitating public and private sector investment in maritime infrastructure and facilities that best support the needs of commercial and recreational boaters, and enables broader economic and social benefits for communities. While supporting maritime infrastructure investment and delivery throughout NSW, the plan focuses primarily on key regional coastal ports and waterways. Included in the MIP are the details of several state government and private funding programs and strategies, including the Boating Now Program.

In 2019, the state government released the *NSW Coastal Dredging Strategy 2019-2024*. The purpose of the program is to adopt a strategic and proactive approach to dredging that delivers recreational boating benefits for local waterways in regional NSW. The strategy identifies the funding arrangements to support delivery of dredging projects to improve the accessibility and safety of regional coastal waterways. As dredging is not a legislative responsibility, the Coastal Dredging Strategy has been developed and is coordinated by TfNSW.

The NSW Flood Prone Land Policy is intended to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

NSW Draft Mainland Marine Parks Network Management Plan (2021 – 2031) will provide a coordinated, streamlined, single plan of management for the five mainland marine parks, Cape Byron, Solitary Islands, Port Stephens-Great Lakes, Jervis Bay and Batemans and will outline priority actions for the mainland marine park network over the next decade. A range of actions regarding research, education, rehabilitation, infrastructure, compliance, planning, policy, rules and partnership activities have been developed based on the best available evidence and engagement with communities and stakeholder groups. A new approach to evidence-based marine park management to conserve not just environmental, but also social, cultural and economic values of marine parks, while reducing threats to those values. Regional Level Plans

The *Hunter Regional Plan 2036* sets regional planning priorities and provides guidance and direction for regional and local planning decisions over a 20-year period to 2036. It provides an overarching framework to guide subsequent and more detailed land use plans, development proposals and infrastructure funding decisions (DPE, 2017).

The *Hunter Local Land Services Strategic Plan* sets the vision, priorities and overarching strategy for LLS in the Hunter region, with a focus on appropriate economic, social and environmental outcomes. The plan focuses on community engagement, setting and delivering local priorities, and determining how the priorities for Local Land Services are best achieved at local level (LLS, 2021). The plan outlines a series of strategies

through which the goals are to be achieved, through the improved management of biosecurity, natural resources, agricultural productivity and emergency management (LLS, 2021). The Strategic Plan is intended to maintain and improve the resilience of the natural systems of the catchment and has a general focus on communities of the catchment and the ecosystem services provided to them by natural resources such as soils and land, native vegetation and aquatic ecosystems.

The *Port Stephens - Hunter Regional Boating Plan 2015* identifies boating safety, access and infrastructure actions for the Port Stephens and Hunter coast regions to be implemented over the period 2015-2020.

The *Port Stephens - Great Lakes Marine Park Operational Plan* (Marine Parks Authority, 2010) outlines how the Port Stephens- Great Lakes Marine Park will be managed to meet key objectives of conserving marine biodiversity, maintaining ecological processes, providing opportunities for ecologically sustainable use, and supporting public appreciation, enjoyment and understanding of the marine park. The Operational Plan was developed in consultation with the then Port Stephens – Great Lakes Marine Park Advisory Committee (Marine Parks Authority, 2010). The plan outlines a series of actions that are grouped into eleven management categories. In accordance with the objectives of the Act, there is a strong focus on the management of biological diversity, resource use in, and adjacent to, a multiple use marine park, as well as maritime heritage and cultural issues.

4.4.3 The MidCoast Council IP&R Framework

As per the requirements of the *Local Government Act 1993*, all NSW local governments are required to prepare a series of strategic plans that conform to the structure of the state Integrated Planning and Reporting (IP&R) Framework. The structure of this framework is depicted in Figure 4-20 and a brief overview of the components is provided below.

The *Draft MidCoast 2032: Shared Vision, Shared Responsibility: Community Strategic Plan* (CSP) is the overarching, visionary document that translates the community's key priorities and aspirations into long-term strategic goals that guide the future direction of the LGA. The Plan represents the highest level of strategic planning undertaken by a local council. As per NSW OLG, 2019, the Plan essentially addresses four key questions for the community:

- *Where are we now?*
- *Where do we want to be in ten years' time?*
- *How will we get there?*
- *How will we know when we have arrived?*

All other plans developed by Council (such as CMPs) must reflect and support implementation of the Community Strategic Plan. In fact, under the CM Act, the objectives and management actions developed as part of CMPs are required to be strategically aligned with the objectives and strategies outlined in the Community Strategic Plan.

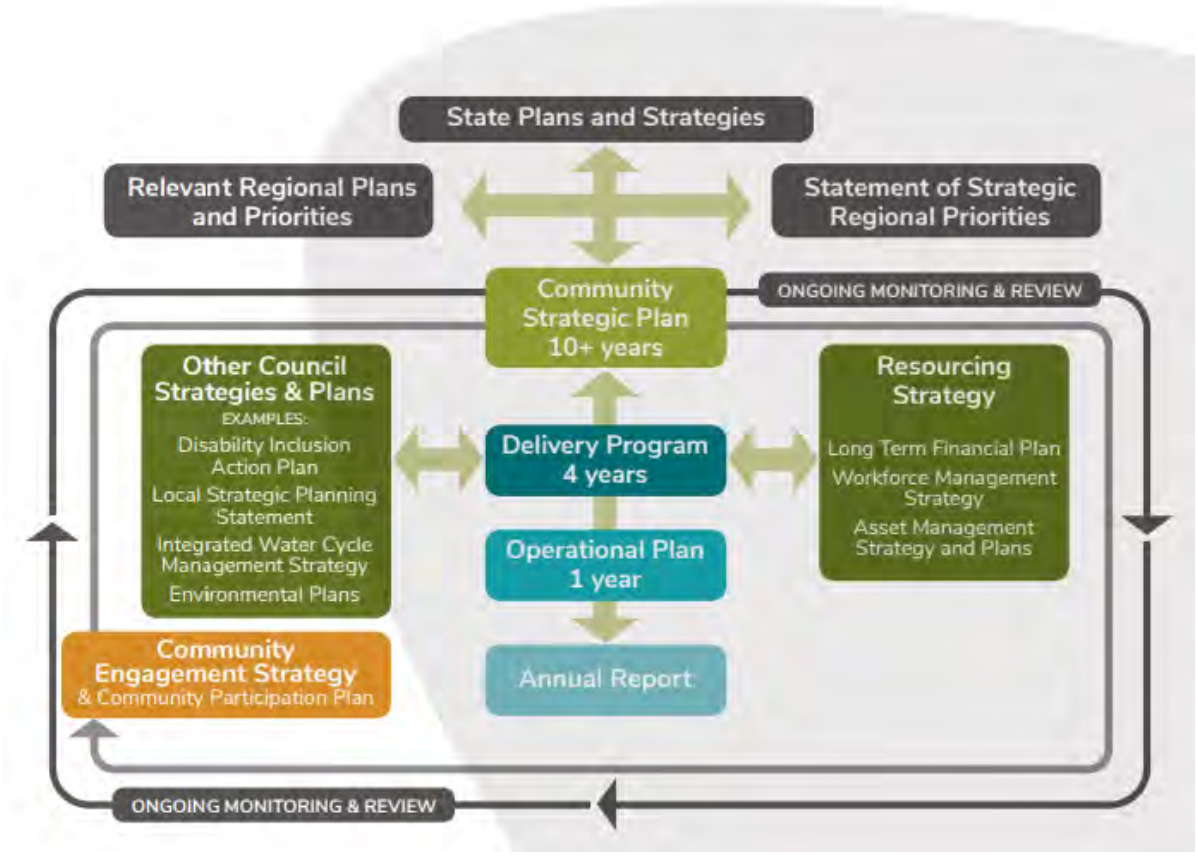

Figure 4-20 Integrated Planning and Reporting Framework (Source: NSW OLG, 2018)

The implementation of the CSP is supported by a suite of integrated plans that include actions to support the strategies identified in the CSP.

The MidCoast CSP brings insights to their shared community values, which are *"Our diverse communities offer active and social opportunities, are safe and are places where we work together with a creative focus acknowledging our rich history and culture. We are socially and physically connected with each other, by ensuring we have activities, facilities, roads, footpaths and technology that are upgraded and well maintained. Our natural environment is protected and enhanced, while we maintain our growing urban centres and manage our resources wisely. We are a place where people want to live, work and play, business is resilient and adaptable to change by utilising knowledge and expertise that supports innovation. We work in partnerships towards a shared vision, that provides value for money and is community focused".*

The *Delivery Program* is a four (4) year program that translates the strategic objectives of the Community Strategic Plan into actions. It identifies all key activities a council has committed to undertake over its four-year life cycle. The *Resourcing Strategy* supports the delivery program and outlines the resources required to implement it. It is therefore a critical link when translating strategic objectives into actions. The Resourcing Strategy generally consists of three inter-related elements: Long-Term Financial Planning, Asset Management Planning and Workforce Planning (NSW OLG, 2020).

The *Operational Plan* is generated over shorter, one-year planning timeframes and provides the detail of the Delivery Program, identifying the individual projects and activities that will be undertaken in a specific year to achieve the commitments of the program.

Reporting is a key element of the IP&R framework. Councils must prepare an Annual Report that provides information regarding progress and success in implementation of the Operational Plan and Delivery Program.

Other strategic planning activities may be undertaken by a council to support the achievement of outcomes in specific areas identified in the Community Strategic Plan (NSW OLG, 2020). These may include, for instance, a Cultural Plan, an Economic and Tourism Strategy, Emergency Risk Management Planning, Climate Change Planning, or even a Heritage Plan.

4.4.4 MidCoast Council Local Planning Documents.

Local Environment Plan (LEP) outlines the aims for the use and development of land within the LGA, in accordance with the relevant standard environmental planning instrument under section 33A of the Environment Protection and Assessment Act 1979. It is the primary planning tool for Council and outlines the local environmental planning provisions for land in the LGA.

As a legacy of merger into one Council in May 2016, MidCoast Council is presently functioning under:

- three Local Environment Plans (LEPs) – Gloucester LEP 2010, Great Lakes LEP 2014 and Greater Taree LEP 2010;
- three Development Control Plans: Gloucester, Great Lakes and Greater Taree; and
- multiple development policies.

MidCoast Council is currently working through a strategic planning program to prepare of a new MidCoast LEP and MidCoast DCP. The preparation of the MidCoast CMP is scheduled in parallel to this process, thus enabling the CMP process to inform the new suite of planning tools as appropriate.

In particular, this may include the improved identification of lands potentially affected by natural hazards including but not limited to coastal wetlands, flooding and tidal inundation; and adaptive management policies and practices for these lands (consistent with State legislative requirements and provisions).

There are several additional local strategies and plans relevant to CMP development, including:

- Local Floodplain Risk Management Plans for the various estuaries
- MidCoast Council Waste Management Strategy 2030 (MidCoast Council , 2019)
- MidCoast Council Integrated Water Cycle Management Strategy _ Our Water Our Future 2045 (MidCoast Council , 2015)
- MidCoast Destination Management Plan (Tourism Destination Management Plan) (MidCoast Council, 2017)
- MidCoast Council Strategic Business Plan for Delivery of Water Services (MidCoast Council 2, 2018);
- MidCoast Biodiversity Framework 2021 – 2030:
- A RoadMap for Conserving Natural Heritage of the MidCoast (MidCoast Council, 2021b)
- MidCoast Councils Cultural Plan 2036 (MidCoast Council , 2021);
- MidCoast Council Climate Change Strategy (MidCoast Council , 2021)
- Regional Economic Development Strategy 2018-2022 (MidCoast Council , 2018); and
- MidCoast Greening Strategy (MidCoast Council, 2021).

In March 2018, amendments to the *Environmental Planning and Assessment Act 1979* (the EP&A Act) introduced a new requirement for councils to prepare and make a *Local Strategic Planning Statement* (LSPS). The MidCoast LSPS sets out the 20-year vision for land use in the LGA, and how change will be managed into the future (MidCoast Council, 2020). The LSPS provides a link between the state government's strategic plans

and Council's local land use plans and guidelines, and forms part of Council's IP&R Framework - providing an important link with the SCP.

4.5 Economic Context

MidCoast LGA's Gross Regional Product (GRP) was $3.43 billion in the year ending June 2021 which represents 0.54% of the NSW Gross State Product (GSP) (CommunityID, 2022). It has 30,250 local jobs, which is 0.74% of the state's employment.

Based on the 2016 Census (ABS, 2016), Health Care and Social Assistance is the largest employer by industry in the LGA, making up 18.5% of total employment. The next two largest sectors are Retail Trade (13.6% of total employment) and Accommodation and Food Services (10.1% of total employment). Agriculture, Forestry and Fishing account for just over 1,500 jobs, or 5.6% of total employment in 2016.

In terms of Value Added, according to REMPLAN (REMPLAN, 2022), Rental, Hiring and Real Estate Services provide the largest contribution, with a total of $844 million (19.4% of the total value added for the LGA). This is followed by Health Care and Social Assistance, with a total value add of $511 million (11.8% of the total value added for the LGA).

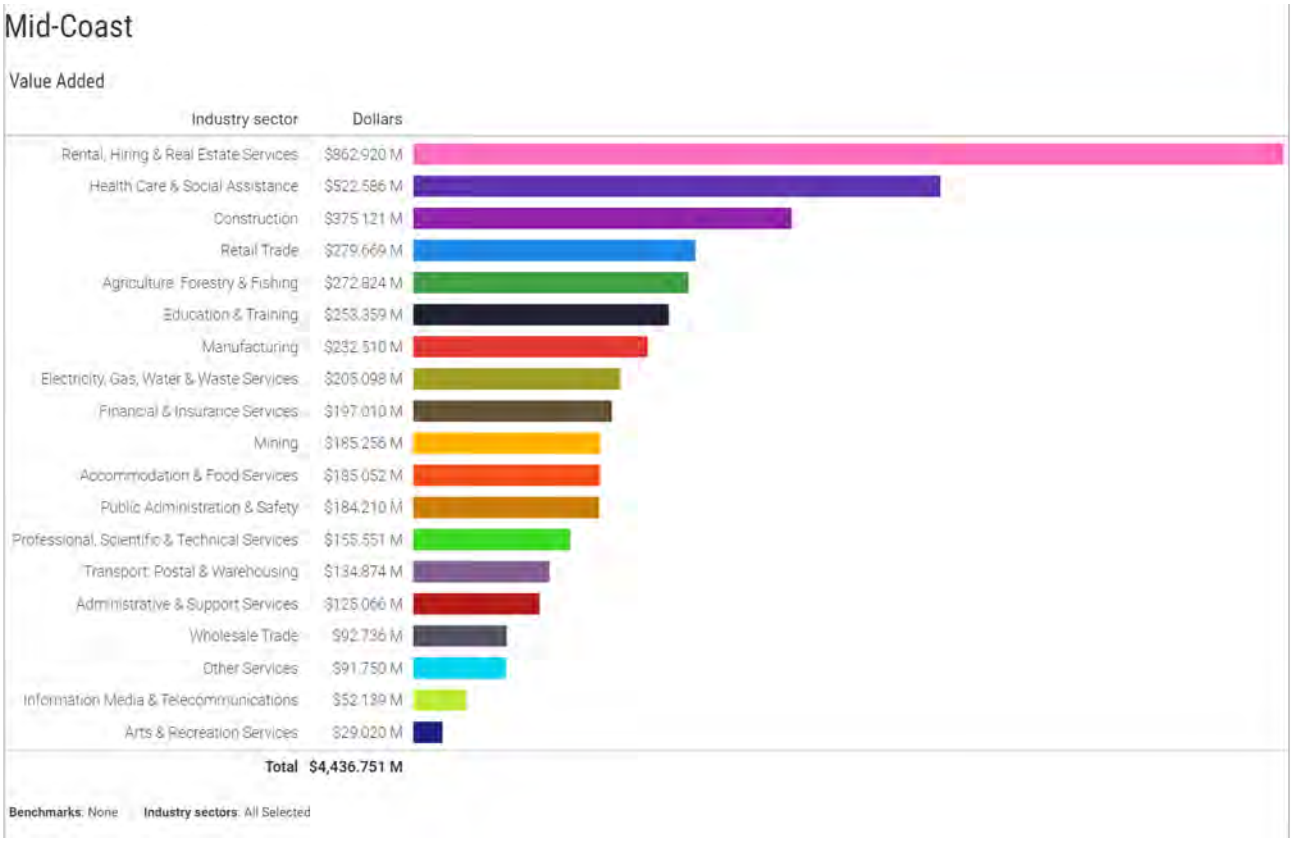

Figure 4-21 MidCoast Council Value Added by Industry (Source: REMPLAN, 2022)

4.5.1 Tourism

Tourism relates to people spending money in places they don't usually live or work. In the MidCoast LGA, this sector creates approximately 2,200 jobs (7.8% of total employment) as of 2019 (REMPLAN, 2022) This is slightly higher than the average for the state and Hunter region. The largest sub-sector in Mid-Coast is Accommodation & Food Services with 1,400 jobs supported by tourist expenditure. The value added by tourism is estimated at $191.590million, or 4.4% of total value added by all industries in MidCoast LGA.

The natural environments and beaches are a major drawcard for tourism in the MidCoast LGA. The MidCoast Tourism Destination Management Plan lists the "Natural environment including world heritage listed national parks, wetlands of international significance, waterways, lakes and river systems" as a major strength for the LGA.

Based on Tourism Research Australia's Local Government Area Profiles for the year 2019 (Australian Trade and Investment Commission, 2019) MidCoast LGA has an annual average of 1,230,000 visitors (based on a four-year average from 2016 to 2019). The average domestic overnight visitor spends 3 nights in the LGA and an average of $455 per trip. An additional 638,000 day and night visitors come to MidCoast LGA to visit friends or relatives.

4.5.2 Ecosystem Services

As part of this Scoping Study, a preliminary economic valuation has been undertaken of the *ecosystem services* across the primary study area catchments, including Wallis Lake, Smiths Lake, Myall Lake/ Lower Myall River Estuary, and the Karuah Estuary. This assessment has been undertaken using the method of Costanza et al (2014) which provides approximate unit values for ecosystem services and land usages. It should be noted that the true value of the ecosystem services in the coastal zone is difficult to capture – and this analysis is not intended to be an in depth economic assessment, but rather is intended as a coarse, *preliminary estimation* in order to gain a broad understanding of the economic value of the study area ecosystems, and to provide high-level guidance for the Business Case (see Section 10). The Costanza (2014) method assigns USD unit pricings for biomes - based on overall estimates of economic value and contribution. For example, tidal marsh and mangroves provide value in the form of storm protection, erosion control, carbon storage and waste treatment. The Table 4-11shows that the ecosystem services of the MidCoast southern estuaries are estimated at around $1.16b per year using this method.

Table 4-11 Approximate Economic Valuation of Study Area Ecosystem Services

Biome	Approx. Area (ha)	Unit Value (USD/ha/yr)	Unit Value (AUD/ha/yr)	Approx. Annual Ecosystem Services Value (AUD/yr)
Mangrove	430	$190k	$250k	$107.5m
Saltmarsh	880	$190k	$250k	$220m
Seagrass	3,080	$29k	$37k	$113.9m
Estuary water body	19,400	$29k	$37k	$717.8m
			Total	**~1.16b**

4.6 Social and Cultural Context

4.6.1 Indigenous Heritage

Indigenous cultural heritage consists of places and items that are of significance to Indigenous people because of their traditions, observances, lore, customs, beliefs and history. It provides evidence of the lives and existence of indigenous people before European settlement through to the present. Indigenous cultural heritage is dynamic and may comprise physical (tangible) or non-physical (intangible) elements. The MidCoast LGA has a rich and continuing Indigenous heritage, with cultural history dating back tens of thousands of years (Great Lakes Council, 2007).

The Biripi and Worimi people are the custodians of the MidCoast area having cared for and lived on Country for thousands of years. The Biripi people are the traditional owners of the land between Tuncurry, Taree and

Gloucester to the north of Wallis Lake while the Worimi people are the Traditional Owners of the land between Barrington Tops and Forster in the north and Maitland and Hunter River in the south (Great Lakes Council, 2012).

MidCoast Council recognises the traditional custodians of the land which makes up the MidCoast LGA - the Gathang speaking (Biripi and Worimi) people. Council enjoys a strong relationship with the local Aboriginal and Torres Strait Islander people, collaborating on a range of projects to acknowledge and celebrate their contribution to the region, and is committees to strengthening those relationships through the Southern Estuaries CMP.

Aboriginal people make up 6.2% of the MidCoast population, more than double the State and Australian averages (2.9% and 2.8% respectively). These vibrant communities contribute extensively to the culture and society of the region and having living cultural and economic connections to Country in the southern estuaries.

There are four Local Aboriginal Land Councils (LALCs with interests in the study area: Purfleet/Taree LALC, Forster LALC, Karuah LALC and Worimi LALC.

The region and study estuaries have a rich indigenous heritage evidenced by the numerous sites found throughout the area. These sites are representative of the close relationship the Aboriginal communities have to the land itself and the creatures of the land and sea. The people of the Wallis Lake area resided in one central camp site now known as Coomba Park which was used until 1843 by the approximately 500 group members (Great Lakes Council, 2014). The majority of the previously recorded sites in this region and other estuaries in the area are middens/artefact scatters close to the estuary foreshore and major creeks that flow into them, including the Karuah and Wallamba Rivers. Other sites that are highly significant to the local Aboriginal community discovered in the area include scarred trees (used for making containers, canoes, shields and boomerangs (Great Lakes Council, 2014)), open campsites, burial grounds, stone arrangements, rock engravings and fish traps (NPSW, 2002). Fishing and the resources of Port Stephens estuary remain extremely important to the contemporary Aboriginal community (Umwelt, 2009).

Fish traps, scarred trees, middens, ceremonial and camping sites, artefacts and a burial site have also been recorded in Aboriginal sites associated with Khappinghat Creek, the coast and Saltwater including the traditional camping area in Saltwater National Park. Saltwater is an also an important meeting and ceremonial area. Prior to the advent of mechanised transport, Aboriginal people walked and rode to Saltwater from Purfleet. The Five Islands Track is thought to be part of one such route ((NPWS, 2019).

There are some individual sites that are not mapped and made publicly available due to concerns from the Aboriginal community that making this information available may lead to damage or vandalism. It should be noted that the LALC's have chosen not to register some sites for similar reasons (Umwelt, 2009). These may be obscured by the soil and/or vegetation, may not yet to be discovered, or are known of by the Aboriginal community but which do not necessarily have physical evidence of Aboriginal occupation (Umwelt, 2009).

Council and the LALCs have a cultural responsibility to protect culture and heritage within its boundary. The *NSW Aboriginal Land Rights Act 1983* is the legislative framework that supports the LALCs in carrying these cultural obligations.

We acknowledge the traditional custodians of the land on which we work and live, the Gathang-speaking people and pay our respects to all Aboriginal and Torres Strait Islander people who now reside in the MidCoast Council area. We extend our respect to elders past, present and to all future cultural-knowledge holders.

4.6.2 Non-Indigenous Heritage

The first European settlement in the Great Lakes area is that of the Australian Agricultural Company's settlement at Carrington – Tahlee on the northern shore of Port Stephens (Great Lakes Council, 2007). The area was initially of limited interest due to the poor soils however experienced rapid growth in the 1860s due to the expanding industry of milling hardwood timber. Agricultural activities expanded into the milled areas, growing the population of settlers in the area with much of these areas having heritage sites associated with them (Great Lakes Council, 2007).

A heritage study of the region was undertaken in 2007 (Great Lakes Council, 2007). This study identified the 72 items currently included in the Local Environment Plan (LEP) along with a further 169 items of heritage significance that are or should be listed on the State Heritage Inventory (SHI) or State Heritage Register (SHR) and thus the LEP. Not all of the 241 items of heritage significance identified within the Great Lakes region fall within the area of the study estuaries, but also include the catchment regions.

The heritage items listed in the study consisted primarily of dwellings and also include bridges, memorial centres and community halls, churches, courthouses, schools, cemeteries, conservation areas, and railway, military and boating infrastructure including harbours and stations. These different infrastructures are centred around the various industries that occur in the region. Early European activity in the region included timber cutting and agricultural practices such as beef and dairy in the early 1800s which progressed to commercial fishing, particularly oysters in Wallis Lake, by the late 1800s (Great Lakes Council, 2009).

4.6.3 Community Uses

The MidCoast LGA coastline has long provided an attractive natural setting for a range of outdoor recreation activities, to both the local community and a regional population that extends beyond the boundaries of the LGA. The coastal waters, foreshore and estuaries of the LGA are highly valued by the local community for the social and recreational amenity that they provide.

These estuaries are popular sites for tourists due to their proximity to Newcastle and extensive national parks that surround the estuaries. The foreshore of both Wallis Lake and Karuah River/Port Stephens have considerably more infrastructure and waterway access than the Smiths Lake or the Myall Lakes as they are contained within a broad corridor of public land that is within easy reach of the surrounding road network and the presence of local townships.

There is a diverse range of recreational usage undertaken in the estuaries including water-based and on-shore activities which utilise the range of settings and opportunities that the estuary environs offer. Foreshore activities include camping, walking and four-wheel driving, especially in the national parks in the southern regions of Wallis Lake (around Booti Booti) and Myall Lake.

There are 16 Council-managed boat ramps across the study area – as discussed in Section 4.6.4 , which allows extensive boating access across the lakes and allows for water-based recreation in the estuaries includes boating, fishing, and swimming and the use of non-powered watercraft such as canoeing, kayaking, and paddle boarding. (Great Lakes Council, 2014).

4.6.4 Coastal Infrastructure

There are extensive coastal infrastructure and facilities across the MidCoast LGA with the most significant discussed below

- Wallis Lake Breakwater and Training Walls:
  - The entrance and downstream reaches of Wallis Lake contain a variety of coastal protection structures and formalised bank protection, including rock armoured training walls (Figure 4-22). One of the major features of the MidCoast LGA Coastline and the Wallis Lake estuary are the rock

armoured training wall / breakwater structures located at the estuary entrance. As with many trained river entrances, the civil works were undertaken in the late nineteenth century and early twentieth century as a means of providing a shipping route and associated facilities to northern NSW. The southern (Forster) breakwater was constructed in 1898 and extended by 90 m in 1966 (WorleyParsons, 2011). At the same time as this extension occurred, the 460 m northern (Tuncurry) breakwater was constructed.

- Boating Infrastructure
  - There are 16 Council-managed boat ramps across the study area that are presented in Table 4-12 below. The number of lanes, construction (concrete or unsealed) and condition are also presented.

Table 4-12 Council Managed Boat Ramps (source: TfNSW)

Asset	Description	Depot
10002276	Boat Launch Ramp - Cedar Reserve Bundaba	Tea Gardens
13103269	Allworth	Stroud
13205233	Andrews Reserve Taree	Taree
13205328	Bohnock	Taree
13104877	Brambles Reserve Tarbuck	Tuncurry
13104875	Bullocky Wharf Nabiac	Tuncurry
13102946	Concrete Tuncurry	Tuncurry
13105144	Coomba Park	Tuncurry
13205488	Coopernook	Taree
13205468	Croki	Taree
10000234	Crowdy Head	Taree
13103359	Curlew Ave Reserve Pindimar	Tea Gardens
13104839	Darawank	Tuncurry
13205192	Endeavour Reserve	Taree
13104510	Forster Boat Harbour	Tuncurry
13103158	Forster Keys	Tuncurry
13205541	Gordon Smith Reserve	Taree
10000236	Gravel Tuncurry	Tuncurry
13205458	Horrace Dean Memorial Park	Taree
13205169	Kendall Reserve Cundletown	Taree
13103329	Lions Park Bulahdelah	Bulahdelah
13103145	Little Street Forster	Tuncurry
13209166	Manning Point	Taree
10000235	Manning Waters Reserve Taree	Taree
13104515	Marine Drive Foreshore	Tea Gardens
13205415	Mick Tuck Reserve	Taree
13104878	Moira Parade Reserve	Tea Gardens
10000237	Mudbishops Point Old Bar	Taree
13205521	Oxley Reserve Harrington	Taree
13104965	Pacific Palms	Tuncurry
13104786	Regional Boat Ramp	Tea Gardens
10000238	Sandy Point Lansdowne	Tuncurry
13105139	Smiths Lake	Tuncurry
13104804	Steve Rich Reserve Bundabah	Tea Gardens

13103341	Waterhen Park Nerong	Bulahdelah
13103290	Winda Woppa Hawks Nest	Tea Gardens
10000233	Cedar Park Coolongolook	Tuncurry
13205665	Kayak Launch Ramp - Endeavour Reserve	Taree
13209168	Kayak Ramp - Queen Elizabeth Park	Taree

Figure 4-22 Coastal Infrastructure at the Wallis Lakes Entrance

4.7 Population and Demographics

The MidCoast LGA has an estimated resident population of 95,209 for the year 2021 and a population density of 9.46 persons per square kilometre (CommunityID, 2022). It is estimated that approximately 40,000 residents live in the southern catchments area of the MidCoast.

The distribution of the local population centres is provided in Table 4-13, with the CommuntyID areas shown in Figure 4-23. This table shows that around 38% of the LGA population lives in or around the study area catchments.

The LGA's population is forecast to grow from around 95,580 to 113,150 from 2021 to 2036, which is about an 18% increase in population. This is slightly lower than the average growth predicted across all of Australia (~22%). The areas around the study area catchments are forecast to grow between 4% to 25% in the same time period. Forster South, Hawks Nest-Tea Gardens, and Bulahdelah-Central Rural are the small areas within the study area that have the highest growth predicted.

Table 4-13 Population Centres across the Study Area (blue shading indicating within study area) (Source: Community ID, 2020)

Community ID Small Area	Population 2021	Percentage of Current MidCoast Population	Forecast Population 2036 (% increase from 2021)
Brimbin	157	0.2%	2,166 (+1,279%)
Bulahdelah - Central Rural	1,910	2.0%	2,247 (+17%)
Crowdy - Harrington - Johns River	4,185	4.4%	4,819 (+15%)
Cundletown	1,779	1.9%	1,811 (+1%)
Forster North	7,625	8.0%	7,859 (+3%)
Forster South - Green Point	7,695	8.1%	9,250 (+20%)
Gloucester	3,134	3.3%	3,642 (+16%)
Gloucester Balance	2,076	2.2%	2,166 (+4%)
Hallidays Point	4,655	4.9%	6,872 (+47%)
Hawks Nest - Tea Gardens	4,555	4.8%	5,642 (+23%)
Nabiac - Failford - Darawank - Rural North	2,889	3.0%	3,365 (+16%)
North Arm Cove - Pindimar - Nerong	1,135	1.2%	1,182 (+4%)
Old Bar - Wallabi	5,142	5.4%	7,806 (+51%)
Old Bar Balance	2,562	2.7%	2,708 (+5%)
Pacific Palms - Blueys Beach - Coomba Park	3,537	3.7%	4,083 (+15%)
Stroud - Rural West	2,780	2.9%	3,078 (+10%)
Taree	18,322	19.2%	21,481 (+17%)
Taree Balance	5,363	5.6%	6,028 (+12%)
Tuncurry	6,375	6.7%	6,785 (+6%)
Wingham	5,216	5.5%	5,784 (+10%)
Wingham Balance	4,493	4.7%	4,375 (-2%)
MidCoast Total	**95,585**		**113,147 (+18%)**

Figure 4-23 MidCoast LGA Population Centres

4.7.1 Planned Development

The population growth described above will require significant changes to the built environment and place additional pressure on the estuaries. An assessment of proposed new dwellings over the period 2016-2036 has been undertaken using the MidCoast Community ID portal (CommunityID, 2022). The number of dwellings in MidCoast Council will increase by an average of 500 dwellings per annum to 60,270 in 2036. Some areas will be experiencing significant growth in new dwellings, either through greenfield development or densification and renewal. A summary of forecast developments is provided in Table 4-14.

Some major residential developments are planned to impact upon estuary foreshores and catchments, particularly around Hallidays Point, Black Head, Old Bar/ Wallabi, Forster and Tea Gardens/Hawks Nest. MidCoast Urban Release areas in these locations are shown in Figure 4-26 to Figure 4-27, extracted from MidCoast Urban Release Areas Report, showing proximity to estuaries and foreshore areas.

Table 4-14 Forecast Major Residential Development 2016-2036 Across the Study Area (Source: CommunityID, 2022)

Small Area	Forecast Residential Development Increases 2016-2036	Major Developments / Release Areas (>40 dwellings)
Hallidays Point	1675	▪ Treeview Drive - 14 dwellings (2012-2019) ▪ Black Head Residual Greenfield - 26 dwellings (2012-2021) ▪ Halliday Shores - 144 dwellings (2012-2021) ▪ Glen Court - 41 dwellings (2012-2022) ▪ South Diamond Beach Residential - 34 dwellings (2012-2023) ▪ Headland Drive - 20 dwellings (2012-2025) ▪ Tallwoods Village (Stages 1-8) - 335 dwellings (2012-2029) ▪ Tallwoods Village - Eastern Lands (Stages 9-14) - 217 dwellings (2012-2033) ▪ Seascape Village - 378 dwellings (2012-2034) ▪ 16 Meers Drive - 19 dwellings (2012-2036) ▪ Proposed Red Head Urban Expansion - 18 dwellings (2012-2036) ▪ Pacific View & Federation Drives - 28 dwellings (2019-2024) ▪ Proposed Diamond Beach Tourist Precinct - 26 dwellings (2019-2026) ▪ Lot 44 Black Head Road - 28 dwellings (2020-2021) ▪ 214 Diamond Beach Road - 79 dwellings (2020-2028) ▪ 363 Diamond Beach Road - 29 dwellings (2022-2024) ▪ Black Head Urban Expansion - 69 dwellings (2023-2036) ▪ 205 Blackhead Road (Urban Release Area UR2) - 96 dwellings (2025-2036) ▪ 310 Diamond Beach Road - 84 dwellings (2025-2036) ▪ Red Head Residual Greenfield - 41 dwellings (2028-2036) ▪ 438 Blackhead Road (Urban Release Area UR 7) - 59 dwellings (2029-2036) ▪ Hallidays Point Urban Expansion (303-323 Blackhead Road) - 73 dwellings (2030-2036) ▪ 210 Diamond Beach Road - 27 dwellings (2031-2036) ▪ 391 Diamond Beach Road - 12 dwellings (2033-2036)
Old Bar- Wallabi	1456	▪ Ivy Crescent - 31 dwellings (2012-2020) ▪ Ocean Blue Estate - 166 dwellings (2012-2021) ▪ Saltwater Beach Estate - 85 dwellings (2012-2022) ▪ Shantull Drive - 26 dwellings (2013-2019) ▪ Old Bar Precinct 2A - Stages 1-8 - 98 dwellings (2020-2028) ▪ Old Bar Precinct 3A - 173 dwellings (2021-2036) ▪ 34-36 Lewis Street - 25 dwellings (2023-2024) ▪ 9 Sheppard Street - 22 dwellings (2023-2024) ▪ Old Bar Precinct 2A - Remainder - 97 dwellings (2023-2031) ▪ Old Bar Precinct 2B - 498 dwellings (2023-2036) ▪ Old Bar Precinct 1 - 16 dwellings (2025-2036)

Small Area	Forecast Residential Development Increases 2016-2036	Major Developments / Release Areas (>40 dwellings)
		▪ Old Bar Precinct 3B - 138 dwellings (2026-2036) ▪ 44-48 Red Gum Road/965 Old Bar Road (Urban Release Area UR2) - 71 dwellings (2029-2036)
Old Bar Balance	142	▪ 857-909 Old Bar Road - 19 dwellings (2031-2036)
Bulahdelah - Central Rural	168	▪ Down Under Brewery Resort - 89 dwellings (2024-2036)
Forster North	703	▪ Palms Estate - 78 dwellings (2012-2021) ▪ Bruce Street aged Care Hostel - 118 dwellings (2017-2023) ▪ Middle Street Residential - 147 dwellings (2018-2020) ▪ Head Street Future - 66 dwellings (2022-2030) ▪ Pipers Creek - 120 dwellings (2023-2032)
Forster South - Green Point	1,093	▪ Akala Drive Residual - 53 dwellings (2012-2025) ▪ Golden Ponds Retirement Village - Stage 2 - 47 dwellings (2015-2016) ▪ Pacific Cape Aged Care - 40 dwellings (2017-2023) ▪ Southern Parkway - 164 dwellings (2020-2031) ▪ Fairview West - 185 dwellings (2023-2036) ▪ Follyfoot Farm - 202 dwellings (2024-2036) ▪ Seven Mile Beach Ec-Living Development - 162 dwellings (2025-2036) ▪ North Cape Hawk Drive Residual - 65 dwellings (2028-2036) ▪ South Cape Hawk Drive Residual - 90 dwellings (2029-2036)
Hawks Nest - Tea Gardens	948	▪ Leeward Circuit Area - 128 dwellings (2012-2020) ▪ The Hermitage Retirement Village - 210 dwellings (2012-2029) ▪ Riverside at Tea Gardens - 198 dwellings (2020-2036) ▪ Myall River Downs - 154 dwellings (2021-2036) ▪ North Shearwater - 86 dwellings (2022-2036)
Nabiac - Failford - Darawank - Rural North	324	▪ Glider Avenue Rural Residential - 50 dwellings (2012-2022) ▪ Failford Precinct - 57 dwellings (2021-2036) ▪ Showground Lane and Pacific Highway (Urban Release Area UR2) - 47 dwellings (2030-2036)
North Arm Cove - Pindimar - Nerong	65	▪ N/A
Pacific Palms - Blueys Beach - Coomba Park	542	▪ Tropic Gardens Drive - 63 dwellings (2019-2036) ▪ Elizabeth Beach Residential Development - 50 dwellings (2020-2028) ▪ Pacific Palms Residual Residential Land - 116 dwellings (2020-2036) ▪ Charlotte Bay Precinct (Urban Release Area UR1) - 142 dwellings (2028-2036)
Stroud - West	249	▪ Simmsville Road (Stroud) - 40 dwellings (2027-2035)
Tuncurry	472	▪ Leo Street Residential Land - 53 dwellings (2012-2023)

Small Area	Forecast Residential Development Increases 2016-2036	Major Developments / Release Areas (>40 dwellings)
		▪ Chapmans Road - 132 dwellings (2023-2036) ▪ Point Road Potential High Density - 148 dwellings (2024-2036) ▪ North Tuncurry - Tuncurry Residential Land - 73 dwellings (2025-2036)
Total	**12,289 new dwellings in MCC**	

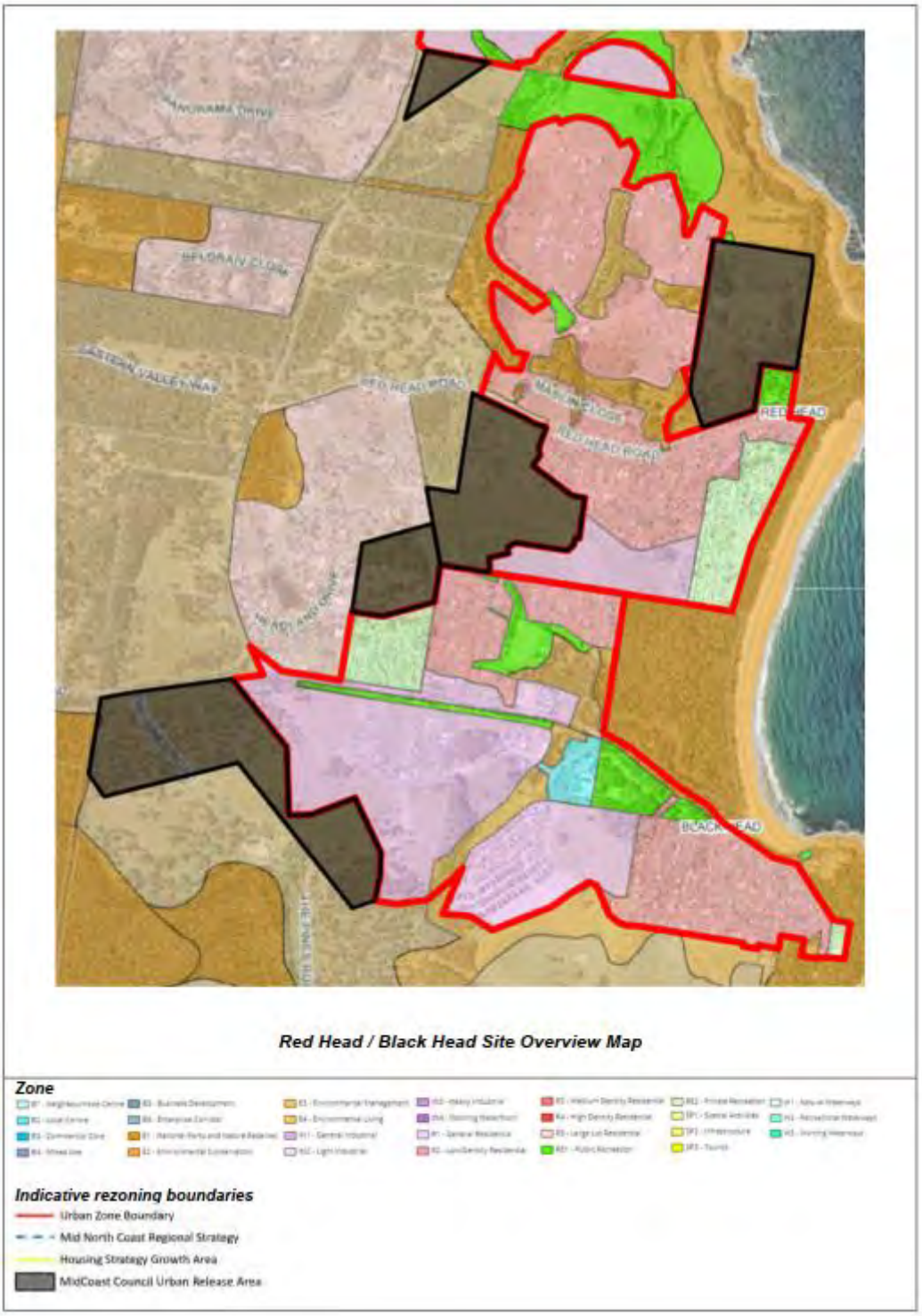

Figure 4-24 Black Head Site Overview Map (Source: MidCoast Council, 2021)

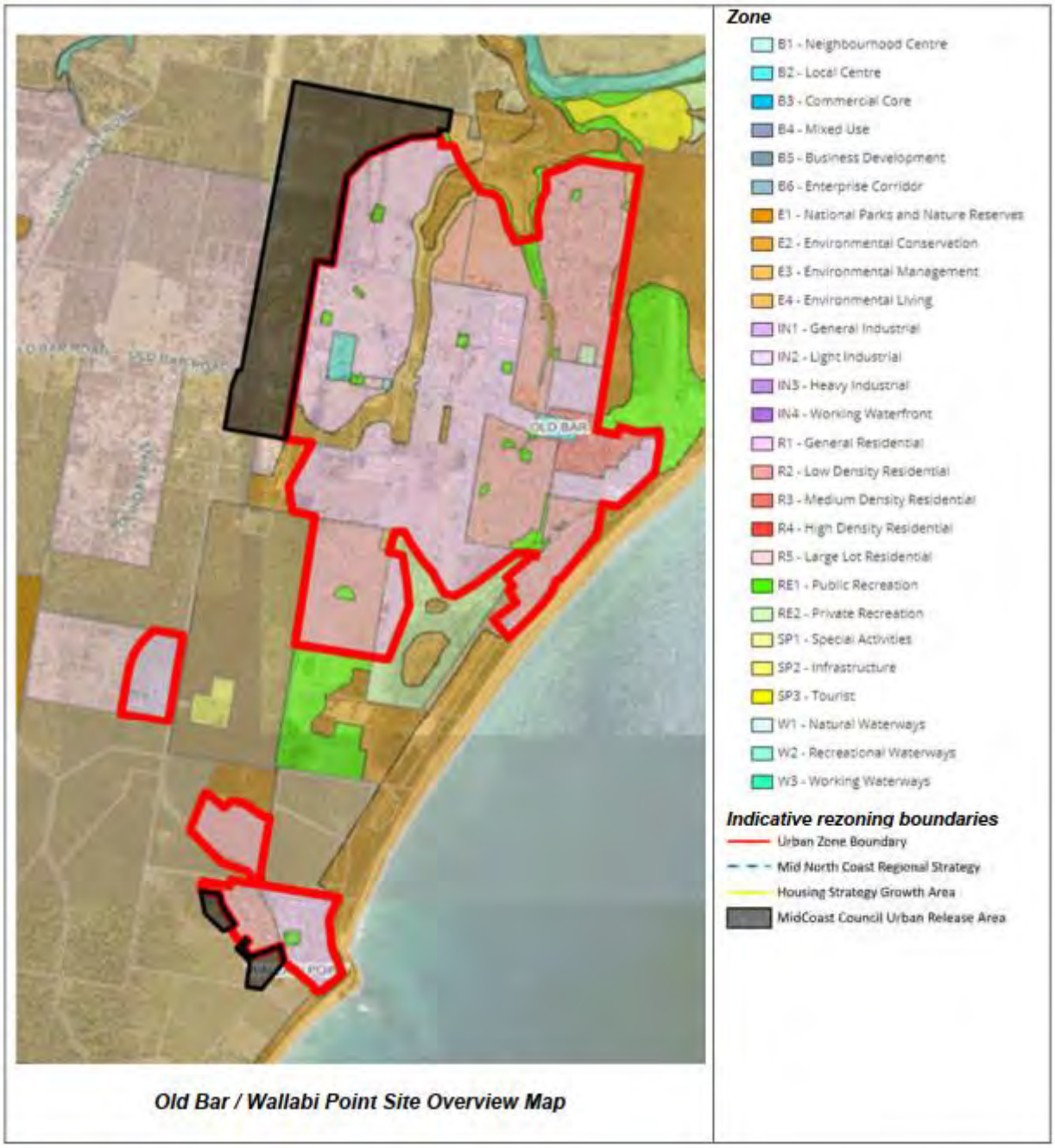

Figure 4-25 Old Bar/ Wallabi Point Site Urban Release Area (Source: MidCoast Council, 2021)

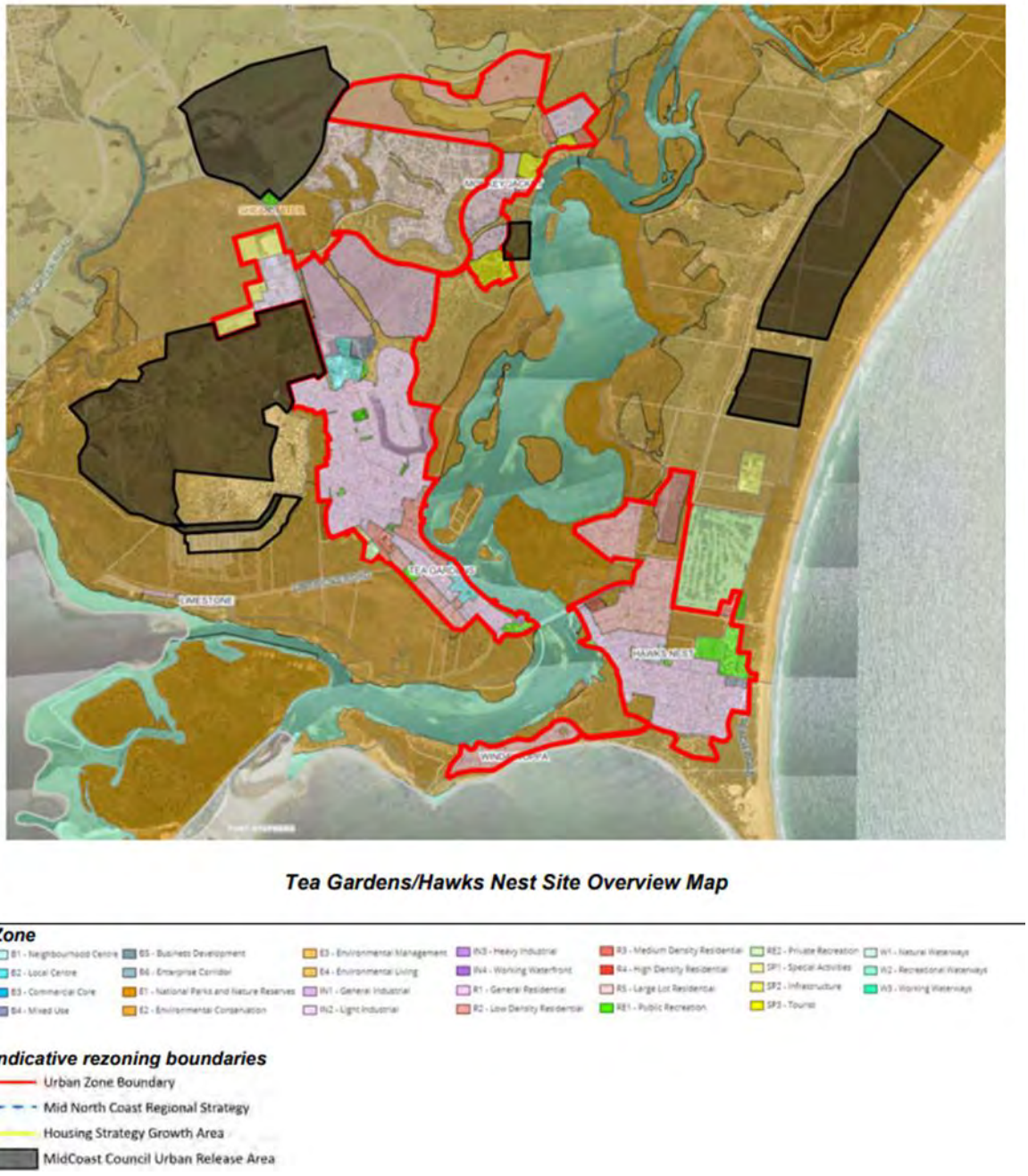

Figure 4-26 Tea Gardens / Hawkes Nest Urban Release Area (Source: MidCoast Council, 2021)

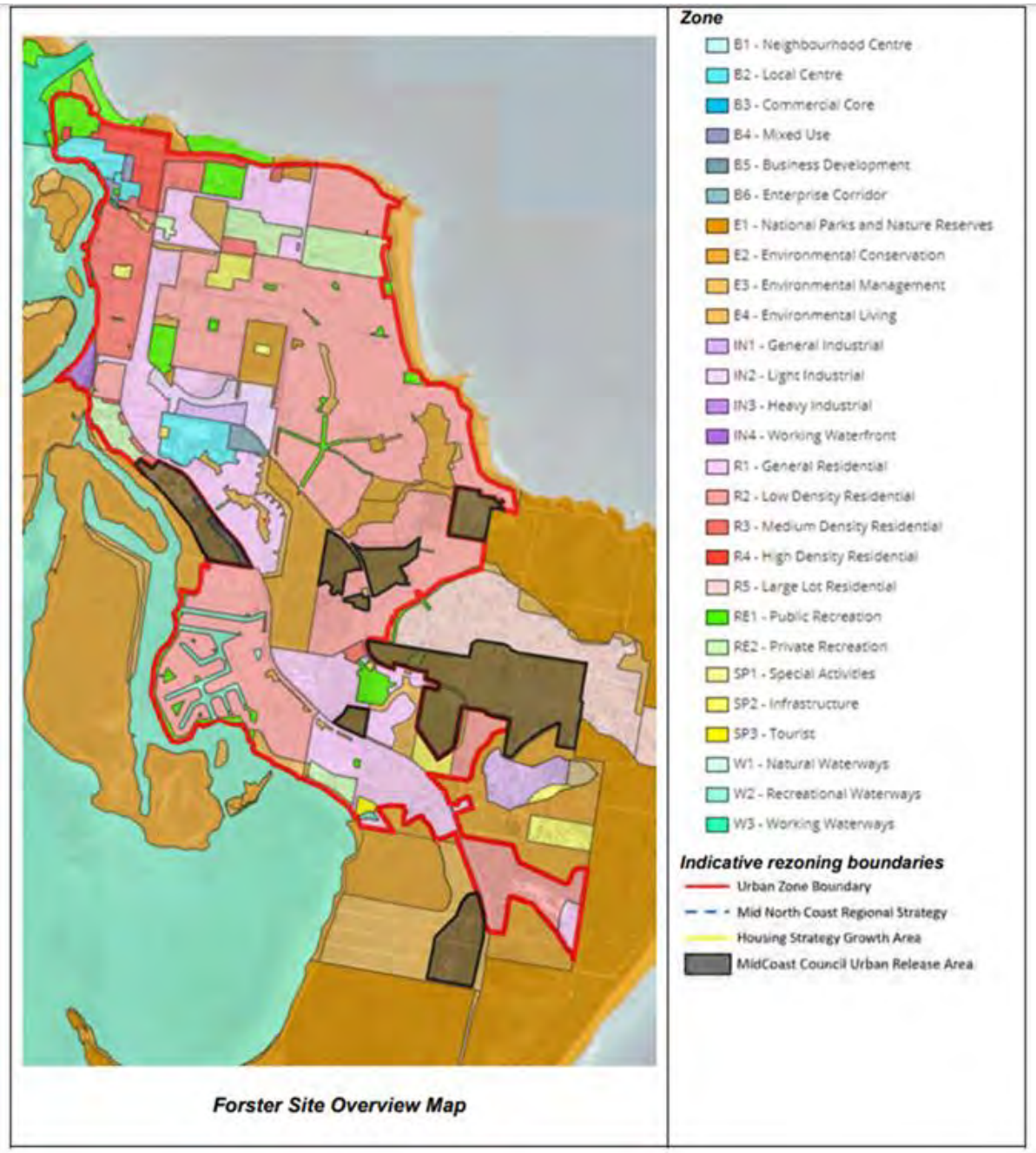

Figure 4-27 Forster Release Area (Source: MidCoast Council, 2021)

5 STAKEHOLDER ENGAGEMENT

5.1 CMP Engagement Requirements and Guidelines

The CM Act requires local councils to consult with the community and stakeholders before adopting a CMP. Section 16 of the CM Act requires that:

1. Before adopting a coastal management program, a local council must consult on the draft program with:
    a. the community, and
    b. if the local council's local government area contains: (i) land within the coastal vulnerability area, any local council whose local government area contains land within the same coastal sediment compartment, and (ii) an estuary that is within 2 or more local government areas, the other local councils, and
    c. other public authorities if the coastal management program: (i) proposes actions or activities to be carried out by that public authority, or (ii) proposes specific emergency actions or activities to be carried out by a public authority under the coastal zone emergency action subplan, or (iii) relates to, affects or impacts on any land or assets owned or managed by that public authority.
2. Consultation under this section is to be undertaken in accordance with the relevant provisions of the coastal management manual.
3. A failure to comply with this section does not invalidate a coastal management program.
4. The regulations may amend Schedule 1.

Part A of the coastal management manual includes statutory provisions and mandatory requirements relating to community and stakeholder engagement. These provisions and requirements include:

> *A draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.*

The NSW Government has issued guidelines for community and stakeholder engagement related to the CMP process titled '*Guidelines for community and stakeholder engagement in coastal management*' (NSW OEH, 2018). These guidelines provide engagement approaches to help meet the above requirements and recommended approaches to enable community and stakeholder feedback to enhance the development of the CMP.

The guidelines recommend the use of the International Association for Public Participation (IAP2) spectrum, which is a widely accepted model to design engagement strategies and plans. As shown in Figure 5-1, the spectrum identifies five levels of engagement, the goal of each level and the community's role in decision-making and implementation.

Increasing impact on the decision →					
Public participation goal (what are we trying to achieve)	**Inform**	**Consult**	**Involve**	**Collaborate**	**Empower**
	To provide the public with balanced and objective information to help them understand the problem, alternatives and/or solutions	To obtain public feedback on alternatives and/or decisions	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered	To partner with the public in each aspect of the decision including the development of alternatives and identification of the preferred solution	To place the final decision-making in the hands of the public
Promise to the public	We will keep you informed	We will keep you informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decision	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision	We will work with you to formulate solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible	We will implement what you decide

Figure 5-1 IAP2 Spectrum (Source: NSW Coastal Management Manual)

The guidelines for Stage 1 of the CMP process recommend the following engagement activities:

- Identify the various stakeholders that need to be engaged in the CMP process;
- Conduct a community profile across the study area;
- Develop a coastal community and stakeholder engagement strategy for all stages in the CMP process; and
- Establish a coastal management advisory group.

5.2 Stakeholder Analysis

As listed in the guidelines there are three broad categories of stakeholders, including the local communities, Local Government (Councils), and other stakeholders (such as state government agencies). Following a stakeholder analysis and assessment of stage one engagement activities an additional category was identified.

All community engagement during stages 2-5 will be utilise these four categories:

- Community
- Special interest groups
- Key stakeholders
- Delivery partners

5.2.1 Community Stakeholders

In the guidelines, 'community' refers to any individual or group of individuals who have something in common. They are members of the public who may be residents in the local government area. Analysis of previous studies and engagement plans related to the study area, identify the following individuals and groups under 'community':

- Residents, in particular those that utilise the estuarine areas
- Tourists/ visitors
- Rural and urban landholders
- Indigenous community members
- Recreational fishers
- Schools and other education institutions

It should be noted that an individual can be in one or more of these groups.

An analysis of the key community groups in the study area was conducted using the Community Directory on the website of MidCoast Council, other online resources, and discussions with Council. The key community and special interest groups are summarised in Appendix A. There also numerous other formal or informal groups in the study area related to specific activities including owners and operators of holiday parks, youth groups, retiree groups, historical societies, activity groups, etc that should be considered in engagement activities.

The guidelines recognise that the following groups can be highly vulnerable to coastal risks (e.g., floods, sea level rise) and thus may require further attention:

- people with disabilities;
- people with culturally, ethnically or linguistically diverse backgrounds;
- Aboriginal and Torres Strait Islanders;
- young people, elderly people;
- single parents;
- people in remote locations;
- business owners; and
- tourists/ visitors.

The aim of engaging with communities is to understand their values and visions and get their feedback on actions and options.

5.2.2 Special Interest Groups

Special interest groups are also consulted with in the coastal management process in order to help identify risks and management options. They can help provide input on feasibility, viability and acceptability of actions. These groups include:

- Environmental Interest Groups
- Beef, Dairy and Oyster Farmers
- Professional fishers
- Recreation Clubs
- Business & Tourism networks
- MidCoast 2 Tops Landcare network
- Karuah Great Lakes Landcare network
- Aquatic Clubs

5.2.3 Key Stakeholders

The aim of the key stakeholders is to Identify risks and management options, capture and integrate scientific, cultural and professional knowledge, and provide input on feasibility, viability and acceptability of the actions.

This includes specific culturally appropriate engagement with Traditional Owners and the Local Aboriginal Land Councils (LALCs), which is an important part of the preparation of a CMP. It is valuable to understand the cultural significance of the coastal landscape and the influence that coastal processes, hazards and environmental change may have on the values of physical and non-physical elements of cultural heritage. The LALCs in the area are:

- The Forster LALC which covers a geographical area between the coast and the Central Highlands, from Seal Rocks in the south to Hallidays Point in the north.
- The Karuah LALC which covers much of the Karuah catchment, between the Forster LALC to the north to Port Stephens in the south.
- Worimi LALC which is south of the Karuah LALC area and covers Port Stephens down to Newcastle.

The LALCs will be engaged throughout the CMP planning process. There may be other Indigenous groups in the study area that should also be involved in the engagement process, such as Aboriginal training groups and Aboriginal service providers. Guidance for engagement with indigenous peoples is provided in *Sea countries of New South Wales: a benefits and threats analysis of Aboriginal people's connections with the marine estate* (Feary, 2015).

- MCC Councillors
- MCC GM and Directors (EMANEX)
- MCC Leadership Group and Management (MANEX)
- MCC Staff
- Department of Planning and Environment (Science unit)
- Department of Planning and Environment (Water floodplains and coast)
- Scientists
- Local Aboriginal Land Councils
- Port Stephens Council
- Emergency Services

The above list includes internal (council) engagement which forms an important part of stakeholder engagement for the CMP process. Council stakeholders include:

- mayor and councillors
- senior leadership team and relevant advisory committees including the technical working group
- council staff – from teams including Natural Systems; Water Services; Community Spaces, Recreation and Trades; Growth, Economic Development and Tourism; Building and Environmental Health; Land Use Planning; Regulatory Services; Engagement, Communication and Education; Coastal, Flooding and Drainage.

5.2.4 Partners

Delivery partners are worked with throughout the process to develop actions and commitment to actions which will address the risks to estuary values. These partners include:

- Local Land Services
- Department of Planning and Environment (Crown Lands)
- Forests NSW
- DPI - Fisheries
- DPI - Marine Parks
- Transport for NSW
- Indigenous service providers
- National Parks and Wildlife Services
- Office of Water

5.3 Community Profile

The stakeholder engagement guidelines for the CMP process recommends that a community profile be developed that identifies key characteristics of the study area. A snapshot of key demographic indicators in the MidCoast LGA compared to the NSW averages is provided in Table 5-1 which is based on the most recent 2016 Census data (Australian Bureau of Statistics, 2016) and collated by CommunityID (CommunityID, 2022). This data can assist in determining engagement strategies and also in the derivation of management actions during Stage 3 of the CMP. An analysis of current and future population is carried out in Section 4.7.

Table 5-1 MidCoast LGA Community Profile (2016 & 2021)

Indicator	MidCoast LGA	NSW
Median age (years)	52	38
<15 years	14.6%	18.1%
60 and over	42.0%	23.5%
Couples with children	17.5%	30.8%
Single parents with children	10.5%	10.6%
Aboriginal and Torres Strait Islander	7.3%	3.2%
Born overseas	10.1%	29.3%
Speaks English only at home	89.9%	67.6%
Households renting	23.9%	30.3%
Bachelor or higher degree	9.9%*	23.4%*
Median weekly household income	$890*	$1,431*
Employed population	91.0%*	93.7%*
**- indicates data from 2016. The Australian Bureau of Statistic (ABS) has released the first batch of data from the 2021 Census and are still processing that data and rolling it out.*		

It is noted that a considerable proportion of the LGA is not in the CMP study area, and thus this community profile is limited spatially. For a more granular investigation of specific communities in the study area the Social Atlas (CommunityID, 2022) has also been used. This is particularly useful for Stage 2 where community vulnerability is assessed and Stage 3 where mitigation options are identified.

There are several notable aspects of the MidCoast community profile apparent from the data in Table 5-1:

- There is a higher median age, a lower proportion of people in the younger age groups (15 years of age or younger) and a higher proportion of people in the older age groups (60+ years) compared to the NSW averages. Areas with a high percentage of retiree-aged populations (65 years and over) include Forster, Tuncurry, Coomba Park, Tea Gardens and Hawks Nest.
- There is a lower percentage of households with couples with children compared to the NSW average.
- There is a higher percentage of Aboriginal and Torres Strait Islander population compared to the NSW average. There are areas with a relatively high Aboriginal and Torres Strait Islander population in Forster.
- There are high levels of people born in Australia and most only speak English at home.
- There is a relatively high level of home ownership with less than a quarter of households renting.
- Less than 10% of the population has a bachelor's degree or higher.
- The income per person is considerably less than the state average. Areas with relatively high proportions of low-income households include Tuncurry, Forster, Coomba Park, Tarbuck Bay, and Hawks Nest.

5.4 Local Engagement Context

A large amount of community and stakeholder engagement activities have been undertaken over the last 15 years for a range of other plans and studies that are highly relevant to the development of the CMP. The findings of all previous relevant community engagement activities should be considered in Stages 2 - 5 of the CMP. The most relevant are discussed below.

5.4.1 Coastal Zone Management Plan for Smiths Lake Estuary (2018)

The consultation for the Smiths Lake CZMP (BMT WBM, 2018) process involved engaging key stakeholders and the local community, who were asked to participate in revising the objectives, issues and actions of the Estuary Management Plan.

The process involved an interactive workshop with stakeholders, a number of phone calls with local residents, a media release, an information poster and a community brochure. The brochure, containing a questionnaire, was distributed to all landholders and residents surrounding Smiths Lake (totalling 1,021 brochures), with some 115 (11%) questionnaires returned.

The information provided direct input into updating the objectives of the Plan, as well as identifying new and emerging issues that need to be addressed in the future.

5.4.2 Wallis Lake Estuary and Catchment Management Plan (2014)

The Wallis Lake Estuary and Catchment Management Plan (Great Lakes Council, 2014) included a range of stakeholder and community consultation.

A key focus of stakeholder consultation was the Wallis and Smiths Lake Coast and Estuary Committee (WSLCEC) and the Great Lakes Catchment Management Group (GLCMG) which oversee and provide input and advice to agencies on issues of management in their respective areas. They include members from industry groups, state agencies, local government, community groups and community members within the committee's area of jurisdiction. As this work was a review of two existing plans, community engagement focused on working intensively with these committees. This involved:

- Facilitated workshops with the WSLCEC and GLCMG throughout 2012 and 2013 to develop the shared Vision and Values and review the threats to the catchment and estuary.
- Update actions from existing Management Plans and identify new actions to address emerging threats
- Review of principles in the Plan and the dredging strategy

- Face-to-face meetings with stakeholders to assess progress and ideas to address emerging threats

The wider community was also consulted through:

- Online survey hosted on Great Lakes Council's website
- Face-to-face engagement of community members through public stalls at community events and markets
- Media releases and radio interviews
- Survey of landholders in the sustainable farming program to determine emerging issues
- Independent review and assessment of the sustainable farming program
- Public exhibition of draft Plan

5.4.3 Great Lakes Water Quality Improvement Plan Wallis, Smiths and Myall Lakes (2009)

The Water Quality Improvement Plan (WQIP) (Great Lakes Council, 2009) was developed in partnership with agencies, industry groups and the community. The focus of the planning process was to provide opportunities for capacity building and joint learning with stakeholders, as well as create opportunities to build awareness within the general community about water quality issues and catchment management. Extensive stakeholder and community engagement involved:

- Advisory Committee: A total of 25 people representing 20 groups were engaged to provide strategic input to the Coastal Catchments Initiative (CCI) during 17 meetings where decisions were made on the strategies to include in the WQIP.
- Rural Management Practice Technical Committee: A committee of catchment management practitioners with landholder representation informed the rural part of the project. Between three and 16 members attended 25 meetings, workshops and field visits to provide input on rural management actions to include in the Farm Scale Action Plan.
- Landholder Reference Group: This was a group of landholders from across the project area formed to provide on-ground input to rural management ideas in association with the Rural Management Practice Technical Committee. Two workshops with this group of six landholders helped to inform the Farm Scale Action Plan, ensuring that the recommendations in the plan were implementable and practical.
- Individual landholders and landcare groups: A total of 55 landholders completed surveys, and several landholders allowed research to be conducted on their properties to better inform the rural part of the plan. Many of these landholders also provided direct feedback on management ideas at workshops, as did several members of local landcare groups.
- General community: A total of 175 interested people (representing 16 groups) helped review the environmental values of the three lakes and provide general suggestions. There were 62 community members who reviewed and suggested catchment management strategies at workshops. A total of 230 people were provided with a presentation on the CCI at two information sessions. The general public received information through the media during the project.
- Internal Water Sensitive Urban Design stakeholder group: Between 10 and 14 officers from Great Lakes Council and MidCoast Water attended four internal working group meetings to help inform urban actions in the WQIP.
- External Water Sensitive Urban Design stakeholder group: Between seven and 14 stakeholders from building, architecture, design and planning companies attended three meetings to ensure the recommendations in the plan for urban areas were implementable and practical from an industry perspective.

- Management Systems group: Between five and nine officers from Great Lakes and Greater Taree councils, and MidCoast Water, attended three meetings to provide input on the types of systems needed to ensure the recommended actions would be implemented.
- Other government agencies and groups: Ten agency stakeholders attended a full-day workshop to review current pollution control systems. A total of 23 presentations on the CCI were made to other agencies, boards and committees.

This engagement was used to develop the plans for each estuary, including the actions required to maintain or improve the ecological health of the systems, determining the current status of the estuaries, and ranking the estuaries' conservation values.

5.4.4 Karuah River Catchment Management Plan (2015)

The Karuah River Catchment Management Plan ensured that the community's values, insights and perspectives were incorporated into the plan. This is completed through several consultation and communication activities which ranged from inform one-to-one farm and industry visits, field days, Participants included representatives from government, industry, Great Lakes Council staff and Councillor representatives and members of the general community. Approximately 80 people attended the Forum on June 19th and approximately 55 attended on June 21st, 2014.

the Council hosted the Karuah Catchment Forum in Stroud on the 19th and 21st of June 2014. The Forum was a critical component of the process of developing the Karuah River Catchment Management Plan. The purpose of the Forum session was to:

- seek ideas for a vision for the catchment and identify catchment values
- identify key catchment threats/pressures as well as key catchment strengths and opportunities
- identify the key management actions and activities that need to be implemented in each of the sub-catchment areas.

SWOT analysis of catchment condition was workshopped with small groups focusing on five themes, which were biodiversity, water, soils and land, community and industry.

The management actions developed within the Forum are grouped into three main themes: education, awareness and community capacity building; provision of incentives; and communication and community engagement.

Community responses were compiled under the four key themes i) Engaged community, involved in Activities, ii) healthy, clean rivers and riparian Zones, iii) Living in harmony with the Beautiful area and iv) healthy catchment and resilient Ecosystems.

5.4.5 Other community engagement

In addition to the engagement specifically undertaken in MidCoast LGA, other state and regional-scale engagement has been undertaken which are relevant to the MidCoast estuaries. This includes:

- Marine Estate Management Strategy (MEMS, 2018) included a survey of around 1,700 NSW residents to collect their values and attitudes in relation to the marine estate. The survey revealed that the NSW community considers the health of the marine estate as a core value. Diversity and abundance of marine life and natural beauty of the marine estate are key economic values for nature-based and regional tourism. Overall, the MEMS survey found that the marine estate is integral to the social and cultural wellbeing of the community.

- The NSW Water Quality and River Flow Objectives (NSW Government, 1999) and more recently in 2022 which collected data on the community's values and uses for our rivers, creeks, estuaries and lakes (i.e., healthy aquatic life, water suitable for recreational activities like swimming and boating, and drinking water).
- The NSW Marine Water Quality Objectives (DEC, 2005) which assessed the environmental values and uses that the community places on NSW oceans.

5.5 Stage 1 Community and Stakeholder Engagement

A variety of community engagement activities were undertaken to inform this scoping study. The community and stakeholder engagement conducted in Stage 1 is detailed in the Community and Stakeholder Engagement Strategy provided in Appendix A. A brief overview is provided below.

5.5.1 Establishment of 'Have Your Say Website'

A web page was added to the MidCoast Council website, which will be active for the duration of the project. Background information on the CMP process and the survey area were added, as well as a link to the community survey.

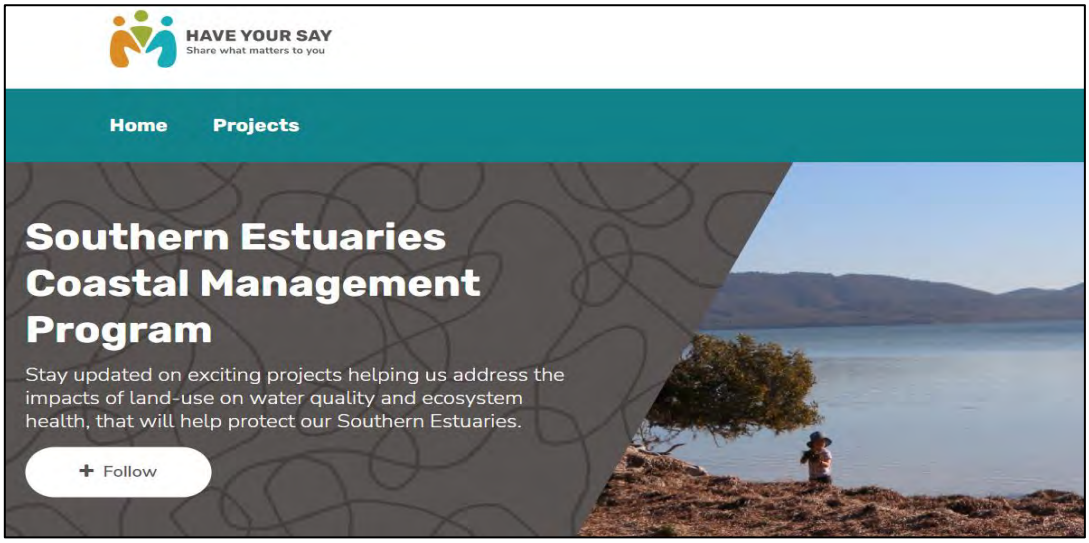

Figure 5-2 The Have Your Say Page

5.5.2 Social Media Posts and Other Media Releases

A total of three social media posts were shared to inform stakeholders about the survey. In total, 8,018 people viewed these posts, with 196 engagements.

A media release was prepared and distributed to local media outlets. The information was picked up and shared in the Great Lakes Advocate and several local radio stations.

A short article was prepared and included in information delivered to the MidCoast Councillors regarding the project and to inform them of the work prior to a workshop being undertaken.

5.5.3 Wallis and Smiths Lake Estuary Committee Workshop

A presentation on the CMP process was provided to the estuary committee, which includes members with various interests in Wallis and Smiths Estuaries. Following this, a workshop was held with the committee members, to assess their values and identify potential risks to these two estuaries.

The main risks identified for Wallis Lake were:

- Sea-level rise
- Overcrowding/congestion of waterways
- Lack of funding for investigation and action implementation
- Urban stormwater runoff
- Climate change
- Urban development

The main risks identified for Smiths Lake were:

- Sea-level rise
- Limited or lack of foreshore and waterway access
- Clearing/disturbance of coastal wetlands
- Lack of understanding of estuary processes
- Climate change
- Vegetation clearing

5.5.4 Technical Working Group Workshop

On 23 March 2022, a workshop was held including 19 participants from Council, DPE, Local Land Services (LLS), Transport for NSW (TfNSW) Maritime, NSW Department of Primary Industries (DPI), DPI Fisheries, NSW National Parks and Wildlife Service (NPWS), Crown Lands, Landcare, University of Newcastle and the University of New South Wales.

A presentation on the CMP process was provided to the group, followed by group discussions on the key risks to the estuaries, major information gaps, and historical barriers and constraints to estuary management. In addition to the discussion, attendees were asked to individually assess the potential risks, threats and stressors acting across the study area by completing and returning worksheets. The results were used to inform and verify the first-pass risk assessment for the project (Section 8). Some of the important topics discussed included:

- QX disease in the oyster industry
- Sea-level rise
- Foreshore development
- Water quality
- Habitat migration/ squeeze
- Habitat disturbance from boat wash
- Extreme events (i.e., storms, fires, floods)
- Coastal hazards (i.e., inundation)
- Increased population growth, tourism and recreational use

See Appendix D for more details.

5.5.5 MCC Internal Working Group Workshop

An internal Council Working Group meeting was held following the Technical Working Group Meeting on 23 March 2022. This involved a follow-up conversation on the key risks to the estuaries, major information gaps, and historical barriers and constraints to estuary management from Council's perspective. Key issues discussed included:

- Lack of environmental data
- ICOLL entrance management
- On-site sewage management
- Urban development and land clearing
- Agriculture runoff
- Water quality
- Growing population and tourism
- Increasing demand for recreational uses
- Lack of compliance

5.5.6 Community Events

CMP information was provided at two community event days including a tree planting event in Forster and a cruise on Wallis Lake. At both days a presentation was given on the background of the CMP process, the

Stage One Scoping Study and residents were encouraged to contribute to the survey. A total of 57 residents were engaged during these events.

5.5.7 Community Survey and Mapping

Council produced an online community survey which was open to the public for a period of three weeks. The survey was designed to provide insight into their key values, use and issues for the Southern Estuaries. Specifically, questions were posed regarding the activities engaged in, the most important values and the biggest issues people had specifically for Wallis Lake, Smiths Lake, Myall Lakes, North Arm Cove, Kore Kore Creek and Karuah River Estuary.

Key insights from the survey are summarised in Figure 5-3 to 5-5 and include:

- A total of 231 survey responses were received over the three-week period.
- The main usage values identified through the survey were:
  - Nature observation (enjoying the scenery, birding)
  - Walking, running or other exercise
  - Picnics/barbecues
  - Recreation on the water (kayaking, canoeing, sailing, recreational fishing from a boat)
  - Recreation in the water (swimming, snorkelling, stand up paddleboard (SUP), wind surfing)

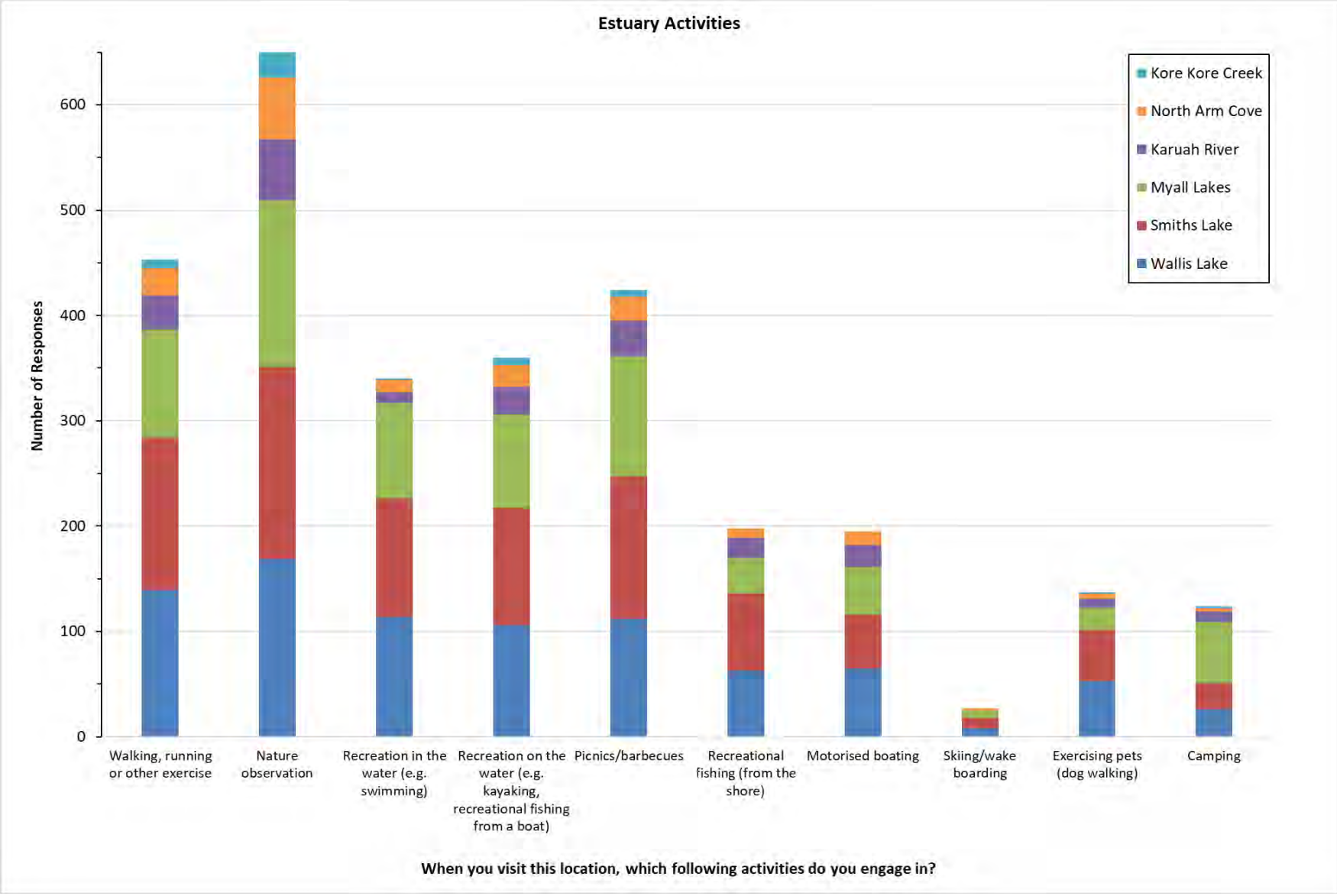

Figure 5-3 Survey results on activities engaged in for the study area estuaries

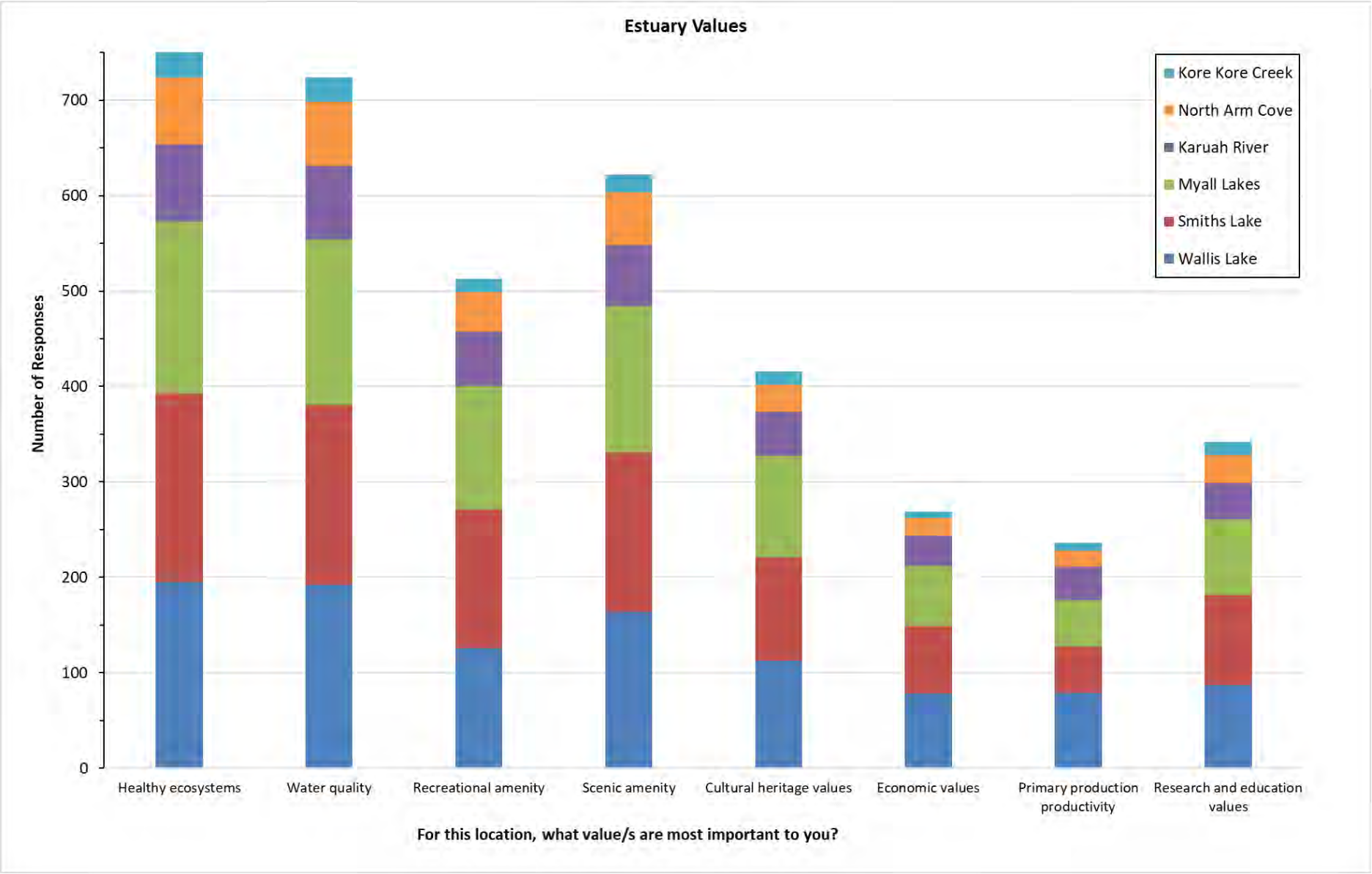

Figure 5-4 Survey results on the most important values for the study area estuaries

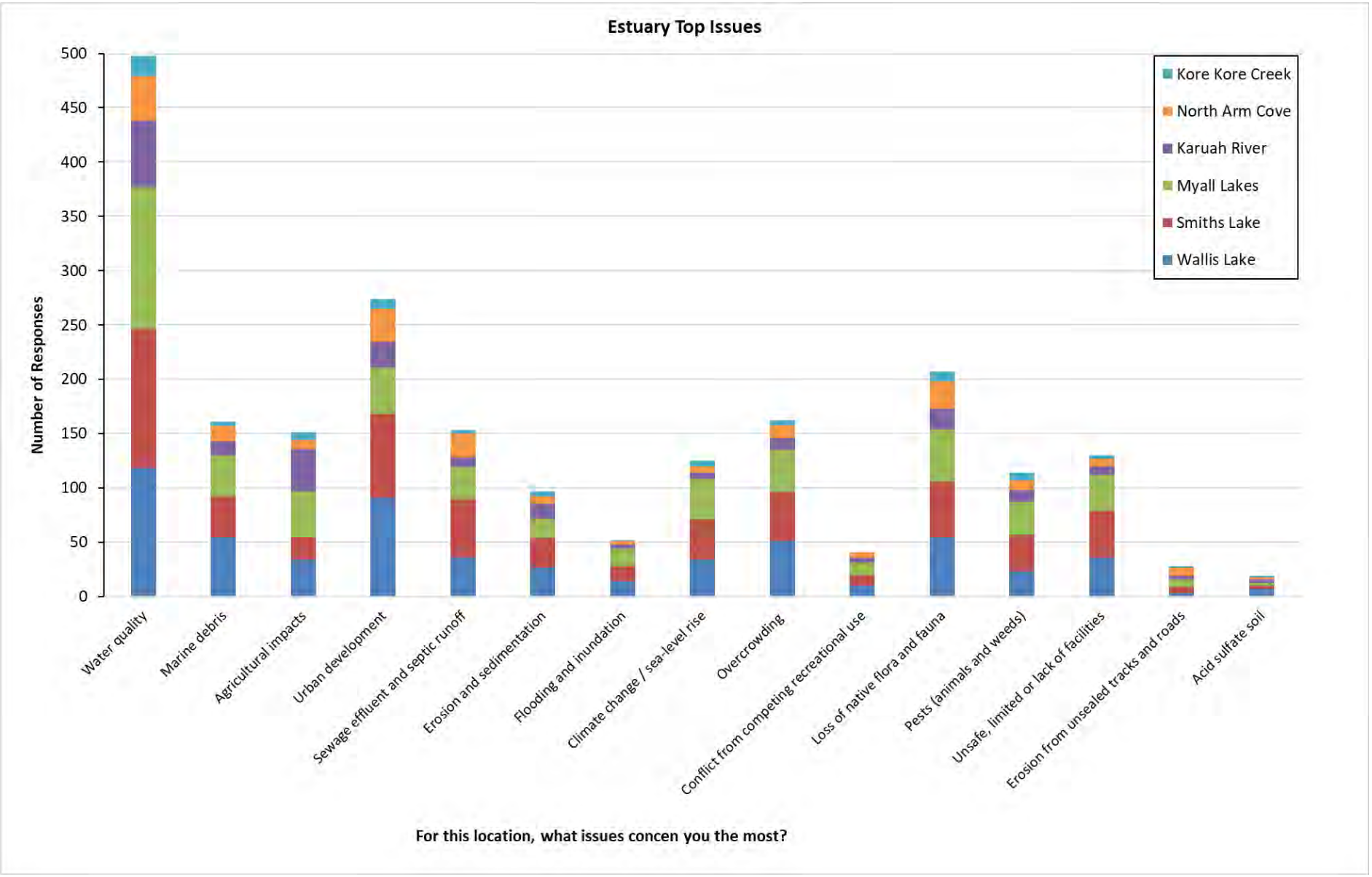

Figure 5-5 Survey results on the key issues for the study area estuaries

The survey results were used to inform the first-pass risk assessment for the project (See Section 8). These results will be further incorporated into Stage 2 of the CMP process.

As part of the community survey, an interactive mapping exercise was undertaken to allow people to identify their values and/or risks spatially. This included identifying where they go for walks, fish, swim, boat or camp, as well as tag location-specific comments to places. This map had a total of 259 unique users who left 172 total comments. A snapshot of the interactive map is shown in Figure 5-6. A sample of comments received is provided in Figure 5-7. Key points raised in the comments included:

- Issues surrounding 4WD access (i.e., by Smiths Lake)
- Preservation of the Smith Lake and Wallis Lake foreshore environments
- Waterway access (i.e., to Karuah River)
- Impacts of increased tourism

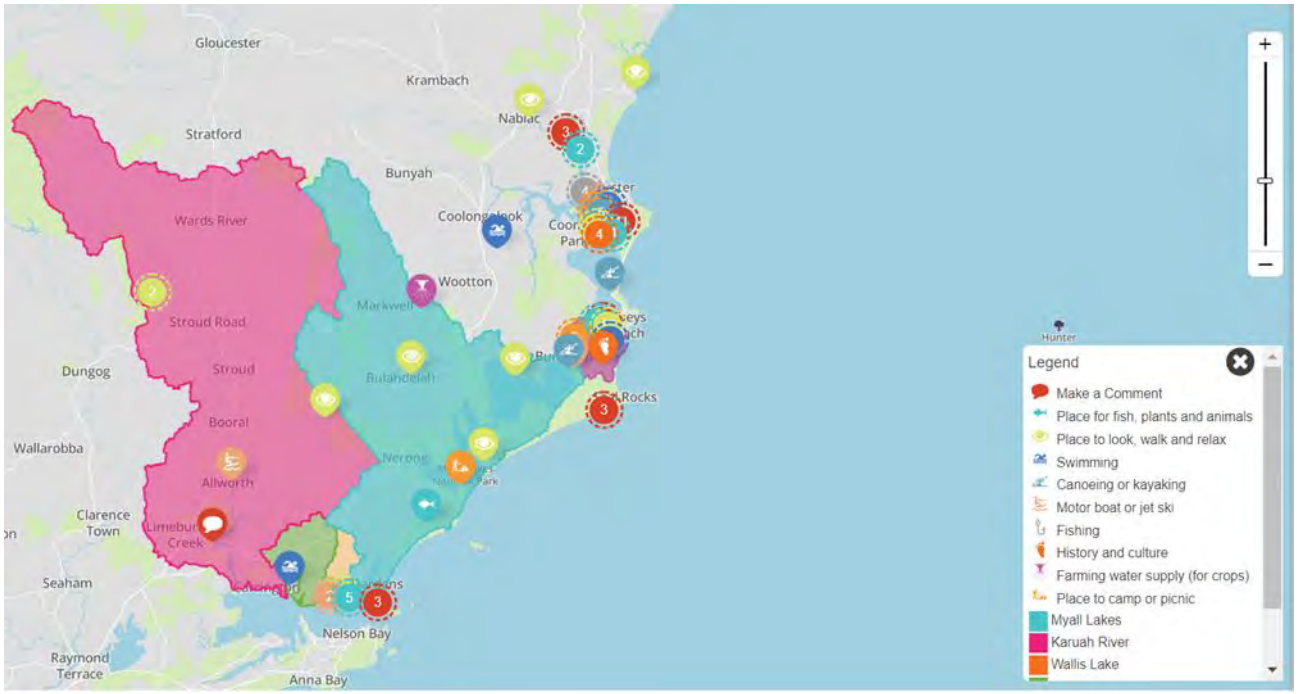

Figure 5-6 Snapshot of interactive map

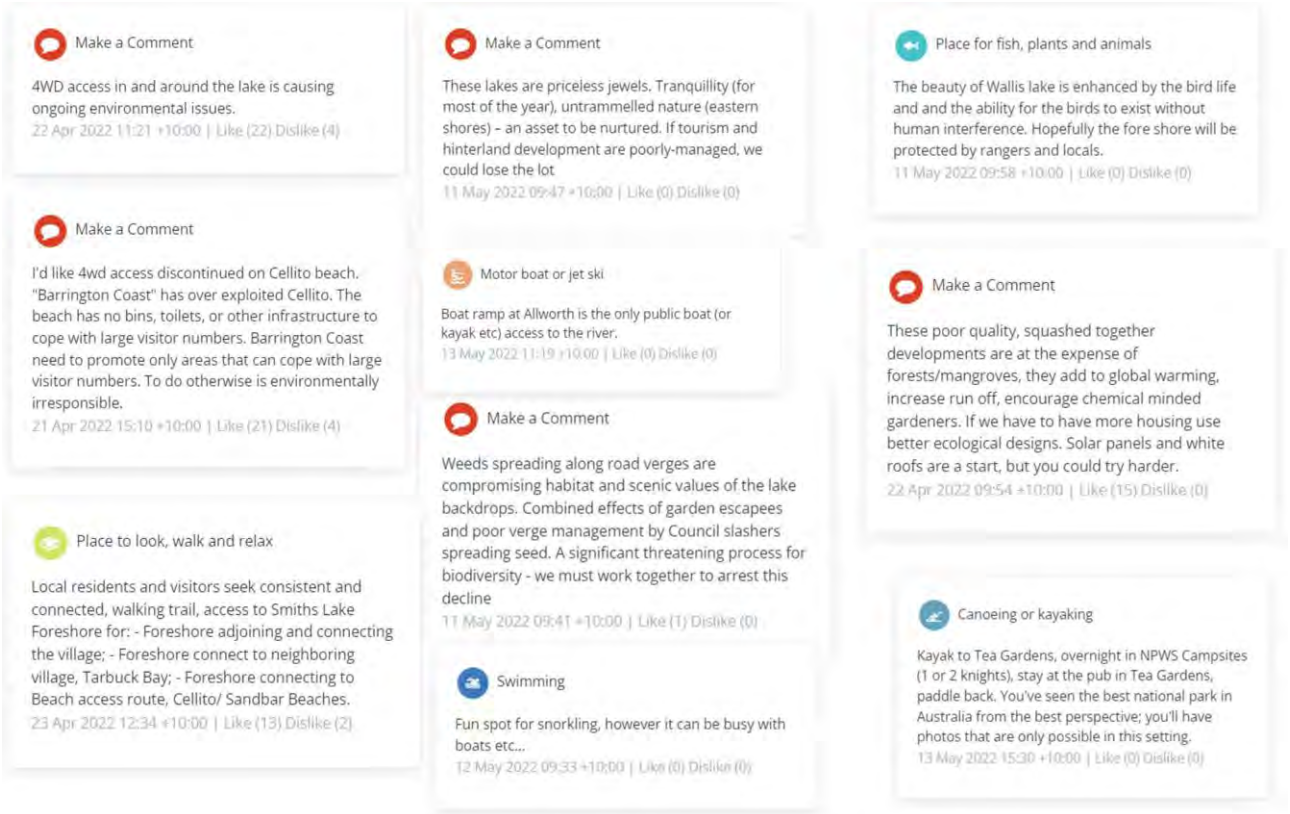

Figure 5-7 Example of comments left on the map

5.5.8 One-on-One Engagement

A number of one-on-one engagement opportunities were undertaken by Council with key stakeholders. These conversations were undertaken with key oyster growers, fishermen and the fishing cooperative. During these discussions the opportunity was undertaken to introduce the project and encourage filling in the survey and map. At these meetings it was also discussed that a reference group would be set up as part of Stage Two and sought feedback on who might be interested in being involved and how they would like to be engaged.

In addition to these conversations, a one-on-one conversation was undertaken with a Woromi elder to seek feedback on who to engage in the indigenous community as the plan is developed. Additionally, a survey was completed at this time.

5.5.9 LALC Consultation

Contact has been made with both the Forster LALC and Karuah LALC. A member of Council has prepared a presentation on the CMP for these groups to inform them of the project and engage them with the project going forward. Unfortunately, the presentation didn't proceed during Stage 1. However, this presentation will be provided, and further engagement undertaken as soon as the meeting is rescheduled.

5.6 Stakeholder Engagement Strategy

The engagement guidelines recommend that a coastal community and stakeholder engagement strategy is prepared in Stage 1 to assist in identifying how the Council and partners will engage with the community and other stakeholders during the preparation of the CMP.

A community and stakeholder engagement strategy has been developed by MidCoast Council and is provided as Appendix A. As recommended in the CMP engagement guidelines, the community and stakeholder engagement strategy has considered:

- Stakeholder analysis
- Community profile
- EMPs and associated studies
- Council's community engagement strategies and,
- Feedback from the local community and other stakeholders during Stage 1 engagement.

It should be noted that the community and stakeholder engagement strategy is only a start and will be refined throughout the CMP process, such as after high-risk issues and user groups are identified in Stage 2. It also should be recognised that the engagement methods in the strategy may need to be refined based on the status of government policy and advice pertaining to the COVID-19 pandemic.

6 REVIEW OF CURRENT COASTAL MANAGEMENT ARRANGEMENTS

6.1 Existing Coastal and Estuary Management Plans

Over the years, several coastal management studies and plans have been developed for the Great Lakes and Port Stephens estuaries and their contributing catchments – in the form of Coastal Zone Management Plans (CZMPs), Estuary and/or Catchment Management Plans (CEMPs/EMPs), Foreshore Plans and Improvement Plans. These plans, outlined below, have been prepared over the last 22 years and together cover most of the CMP study area. These plans are described in more detail in Sections 6.1.1 to 6.1.6. Since the finalisation of these plans, the NSW Coastal Reforms have changed the way estuary and coastal management plans are prepared and implemented.

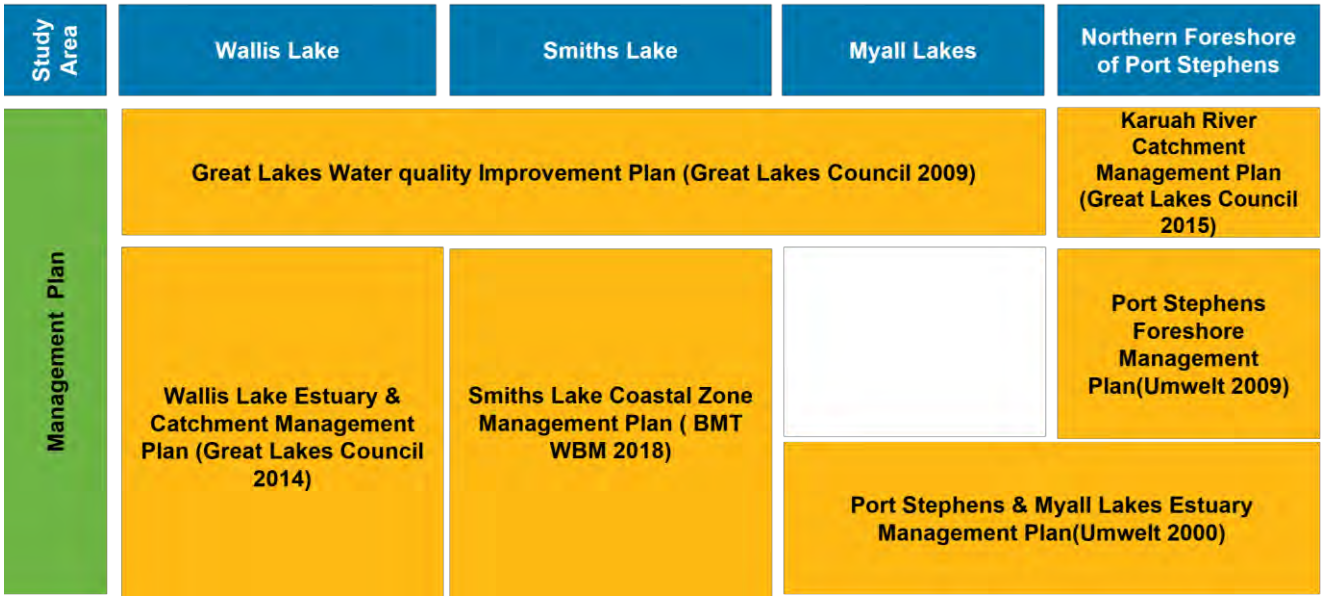

Figure 6-1 Framework of Existing Coastal and Estuary Management Plans

6.1.1 Port Stephens and Myall Lakes Estuary Management Plan (2000)

The Port Stephens and Myall Lakes Estuary Management Plan (Umwelt, 2000) was finalised in 2000 and presents a plan for managing the Port Stephens and Myall Lakes estuary over a 5 to 10 year period. The plan covered the waterways of Port Stephens, Myall Lakes, and Karuah River and their tributaries up to the limit of tidal influence along with the catchment areas of these waterbodies. The plan is part of a strategy implemented by the (then) Port Stephens and Great Lakes Councils to apply the principles of ecologically sustainable development in the region.

The plan developed flows from various studies but primarily the *Draft Estuary Management Study*. This study provides important background information to the plan and is the key document that underpins and justifies the actions and priorities outlined in the Estuary Management Plan. Detailed stakeholder and community consultation was also undertaken during the study in order to identify the aspects of the estuary that are valued, and any issues that affect those values with the comments and feedback received used to inform the new plan.

The purpose of the *Estuary Management Plan* is to guide Council, relevant stakeholders and the community on the use and development of the estuary and its surroundings to protect and enhance the environment and lifestyle that are both highly valued by the local community. The specific objectives of the plan include:

- developing a decision-making process to assist the community in evaluating the potential impacts of future development on the environmental and socio-economic values of the estuary
- recommending actions that are consistent and integrated with other current strategic planning and policy initiatives in the region
- to provide for structured and prioritised management of key issues in the estuary, identify responsible stakeholders and properly assess the costs and benefits of management actions
- to provide detailed and practical advice on management actions for local areas
- to increase community awareness and understanding of estuary management issues and natural estuarine processes, and provide opportunities for the community to engage in decision making about estuary management issues
- to provide community groups with a strategic context for their work.

The plan identified a variety of values considered to be at risk as result of the absence of integrated management frameworks and provided guidelines and timeframes for implementing strategies to address these issues identified.

The plan was adopted by Council in 2000.

6.1.2 Port Stephens Foreshore Management Plan (2009)

The Port Stephens Foreshore Plan (Umwelt, 2009) was finalised in 2009 and provides a framework that can be used to protect and enhance the environmental, recreational, aesthetic, economic and cultural values of the Port Stephens foreshore. The plan builds on and augments the findings of a large number of previous studies and is a direct recommendation of the *Port Stephens and Myall Lakes Estuary Management Plan* (Umwelt, 2000). This new plan complied and condensed the actions and management needs of the various relevant documents and provided additional information where necessary to fill knowledge and management gaps.

The plan production involved two stages:

- Stage 1: Data Collection which involved identifying all foreshore assets and issues through literature review, field studies and community consultation.
- Stage 2: Prioritisation and Management Actions that can be implemented in each management zone to rehabilitate, protect and enhance the foreshore values.

The plan was adopted by (then) Port Stephens Council in April 2009 and by Great Lakes Council in July 2009.

6.1.3 Great Lakes Water Quality Improvement Plan (2009)

The Great Lakes Water Quality Improvement Plan (WQIP) (Great Lakes Council, 2009) was developed as a framework for practitioners and catchment/ estuary management groups to improve water quality in Wallis Lake, Smiths Lake and Myall Lakes. This plan covered the lakes and surrounding catchments. It was developed in partnership with agencies, industry groups and the community with a focus on the planning process to provide opportunities for capacity building and joint learning with stakeholders as well as create opportunities to build awareness within the greater community about water quality issues and catchment management. In developing the WQIP three main components were considered

- Water quality research to identify the current status of the systems and develop catchment and estuarine models of sediment and nutrient loads to the Wallis, Smiths and Myall Lakes.
- Identifying rural, urban, rural residential and management support actions to reduce sediment and nutrient loads entering the lakes.

- A decision-support system to assist with decision-making in relation to how activities on the land will impact on water quality and ecology of the lakes.

Based on both new and existing research, modelling and community engagement, a range of protection and management support actions to protect, support and, where required, restore the ecological health of these systems were identified. These management strategies identified and outlined in the WQIP targeted two specific purposes:

- To remediate existing areas of high pollutant loads, and thus reduce catchment loads and improve estuarine health
- To protect areas of high conservation status that currently provide substantial water quality and biodiversity benefits to the rivers and lake systems

The WQIP focuses primarily on algae concentration and water clarity as indicators of estuarine ecological condition due to the impact increased algal biomass and decreased water clarity can have on estuarine function and used microalgae (chlorophyll-a), water clarity (turbidity) and extent of seagrass as the primary indicators of estuarine condition. All water quality targets, and trigger levels are set in accordance with the *National Water Quality Management Strategy, Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000).

The Great Lakes WQIP underpins many future reports and was implemented by Council in 2009.

6.1.4 Wallis Lake Estuary and Catchment Management Plan (2014)

The Wallis Lake Estuary and Catchment Management Plan (E&CMP) (Great Lakes Council, 2014) was finalised in 2014 and outlines recommendations for management actions to provide a unique and sustainable environment balanced with lifestyle opportunities through development, infrastructure and services. The scientific information underpinning this new Management Plan was adopted from that developed in the *Great Lakes WQIP* (Great Lakes Council, 2009) and the subsequent research and management projects that followed. The Plan was also developed through extensive review of the existing *Wallis Lake Estuary Management Plan* (Great Lakes Council, 2005) and *Wallis Lake Catchment Management Plan* (Great Lakes Council, 2003) in conjunction with internal and external stakeholder engagement.

- Wallis Lake Catchment Management Plan (Great Lakes Council, 2003): Provided a vision and framework that promoted long-term environmental benefits in the Catchment through increased community engagement and understanding of environmental risk and threat management. It increased capacity for stakeholders and rural landholders to implement management projects that promoted sustainable land management and best management practices in the Catchment to ensure the protection of Wallis Lake.
- Wallis Lake Estuary Management Plan (Great Lakes Council, 2005): Adopted in 2005 as the guiding document for Wallis Lake estuary management that listed 143 actions for improving the condition and quality of the management of Wallis Lake environment.
- Following this extensive review, a series of objects were developed and divided into the management areas of Water Quality, Ecosystem Health, and Community Wellbeing with the responsibility of implementing each objective falling under the relevant stakeholder(s). These objects were developed to provide integrated management strategies for both the estuary system and the broader land catchment area due to the health of the Lake and Estuary being fundamentally linked to the health of the entire Catchment. This Plan has been guided by Great Lakes Council's Community Strategic Plan (Great Lakes Council, 2012) and will be used to inform Council's Four-Year Delivery Program and One Year Operational Plans.

The Wallis Lake E&CMP was adopted by council in 2014.

6.1.5 Karuah River Catchment Management Plan (2015)

The Karuah River Catchment Management Plan (KRCMP) (Great Lakes Council, 2015) was developed in 2015 in response to the ecological health assessment undertaken in 2011/12 by the NSW Office of Environment and Heritage that determined the Karuah River, and its estuary, were in moderate ecological condition with indicators of poor and degrading ecological condition. It was established to provide a framework that guides future management actions to ensure the long-term health of the catchment through the restoration and preservation of the catchment's ecosystems. The plan is underpinned by the following four guiding principles:

- the importance of community participation in managing the catchment.
- the value of healthy rivers and riverbanks.
- the interdependence of the catchment's health and the local economy
- the importance of ecosystem resilience.

It was determined that, for the plan to be successful, actions must incorporate these guiding principles. To achieve this, the plan covers three themes:

- Water
- Landscape, Production and Community
- Resilient Ecosystems

The plan identifies some of the key issues in each of these themes and outlines the desired outcomes for the catchment and river that address these key issues. It provides the management actions required to achieve these desired outcomes and the key stakeholder(s) and participating partners involved and responsible for undertaking these actions.

The KRCMP was adopted by Great Lakes Council in 2015.

6.1.6 Smiths Lake Coastal Zone Management Plan (2018)

The Smiths Lake Coastal Zone Management Plan (CZMP) (BMT WBM, 2018) was finalised in 2018 with the primary purpose of acting as a guide for future Council actions. It provides strategic direction and specific focus for the short and long-term sustainable management of the Smiths Lake Estuary, its tributaries, its surrounding foreshore lands, and its catchment insofar as catchment activities impact on the condition of the Lake. The Plan has a particular focus on maintaining or improving the environmental qualities and attributes of Smiths Lake Estuary.

The CZMP represents an update and revision of the previous *Smiths Lake Estuary Management Plan* (Great Lakes Council, 2001) which outlines actions that should be followed in order to maintain Smiths Lake as a healthy and productive estuarine ecosystem. The review involved revising each of the values, issues, objectives and actions to determine which are still relevant and which have become redundant since 2001. This review process also involved extensive stakeholder and community engagement and consultation to enhance the improvement of the existing plan.

Following the review process, the revised CZMP plan was designed to assist to achieve improved environmental conditions balancing human and ecological demands on the Lake. This involved providing implementation tables to fulfil Council's requirement for applying the principles of Ecologically Sustainable Development to Smiths Lake and its catchment.

The plan was adopted by MidCoast Council in 2018.

6.2 Implementation of Existing Management Plans

As part of this Scoping Study, an audit was undertaken of the recommended actions and strategies put forth in the various management plans described above. This was undertaken in consultation with Council and comprised a review of the 284 discrete management actions recommended in existing CZMPs and EMPs (see Section 6.1).

The results of the audit are provided in full in Appendix C. For each action item within each plan, information has been provided regarding the current status of that action – with a designation that fits into one of six (6) categories:

- ***Completed (Code: C):*** Where discrete (one-off) actions items have been completed and no further actions is required.
- ***Implemented and Ongoing (Code: O):*** Where actions have an ongoing component and are currently being implemented.
- ***In progress / Incomplete (Code: IP):*** This includes actions that are in progress or not yet finalised.
- ***Not Commenced / Outstanding (Code: NC):*** Where outstanding actions have not yet commenced - but have been marked for future implementation.
- ***No Longer Applicable (Code NLA):*** Where actions are no longer applicable due to changed circumstances or superseding actions from other management plans.
- ***Unknown (Code U):*** Actions where the status is unknown or do not necessarily fit into the above categories.

A summary of the audit is provided in Table 6-1, which provides a breakdown of action implementation across the various management plans. Council has given effect to many of these actions through their IP&R frameworks which are manifest in their delivery program and annual operational plans.

Table 6-1 Summary of Audit

Plan	Total Actions	C	O	IP	NC	NLA	U
Wallis Lake ECMP	115	5	57	13	16	10	14
Smith's Lake CZMP	51	11	11	7	16	2	4
Karuah River CMP	73	2	25	7	12	3	24
WQIP	45	2	18	9	11	0	5
Total	**284**	**20(7%)**	**111 (39%)**	**36 (13%)**	**55 (19%)**	**15 (5%)**	**47 (17%)**

Results in this table and Appendix C show that about half (46%) of the actions outlined in these plans have been completed or implemented, whilst another 13% are currently in progress.

However, it should be noted that over 19% of actions have not commenced or are outstanding. There are a number of constraints and limitations that have historically impeded the ability to plan and implement estuary management actions – and these are discussed in Section 6.4.

6.3 Monitoring Programs

There are a number of coastal and estuary monitoring programs in effect across the study area, and a brief summary is provided herein.

6.3.1 Water Quality Monitoring

Waterways and Catchment Report Card Program

This is a catchment based estuarine and freshwater monitoring and reporting program currently implemented by a partnership between MidCoast Council and the NSW Department of Planning and Environment. The program has been running for the last 10 years and is designed to monitor and investigate the water quality of the waterways in the 6 major catchments within the LGA, including Karuah River, Myall Lake, Smiths Lake and Wallis Lake.

The scientific understanding underpinning this program is sourced from the *Great Lakes WQIP* (Great Lakes Council, 2009) which sets targets and specific outcomes centred around water clarity and algal abundance. These report cards aim to progress towards these outcomes by measuring the same parameters annually to act as a tool to monitor the progress.

- The Report Card program includes five (5) main steps to evaluating the catchment health:
  - Selecting the indicators – Chlorophyll, as an indicator for algal abundance, and turbidity, as an indicator of water clarity, were chosen as the primary parameters to be measured and form the bases of the ecological assessment.
  - Identifying the trigger levels – the trigger levels used in these report cards are based on the 'normal' ranges that have been established through extensive monitoring of estuaries across NSW. The trigger levels indicate that of which undesirable conditions for continued waterway health occur and vary depending on the different type of estuary. The estuaries monitored in this program and their specific classification is presented in Table 6-2.
  - Collecting the data – Samples from each site are collected on six (6) occasions between summer and autumn from December to March when the highest chlorophyll concentrations are expected. These samples are collected in accordance with the New South Wales Monitoring, Evaluation and Reporting protocols.
  - Calculating the zone score – Zone scores are calculated as a function on the non-compliance score, or the proportion of samples above the trigger value, and the distance from the benchmark score, or how far from the trigger value. This allows for comparison between different reporting zones.
  - Allocating the Report Card grade – The grades of a zone represent the condition of the estuary compared to the condition of all NSW estuaries and is allocated based on the zone score previously calculated.

The Report Card program produces two main products including a comprehensive technical assessment of riverine health report and an easily interpreted report card summarising the zone findings and displaying this information in an easy-to-understand visual format (Figure 6-2). The most recent round of monitoring was the 2021 Report Card with sampling occurring between November 2020 and April 2021.

Table 6-2 Estuary Classification of each testing location

Site Classification	Testing location
Lakes	Wallis Lake
	Pipers Creek
	Charlotte Bay
	Bombah Broadwater
	Myall Lake
	Smiths Lake
River Estuary	Wallamba River
	Karuah Estuary
	Wallamba Cove
	Branch Estuary
	Lower Myall River
	Upper, Mid and Lower Manning Estuary River
Creek Estuary	Khappinghat Lagoon

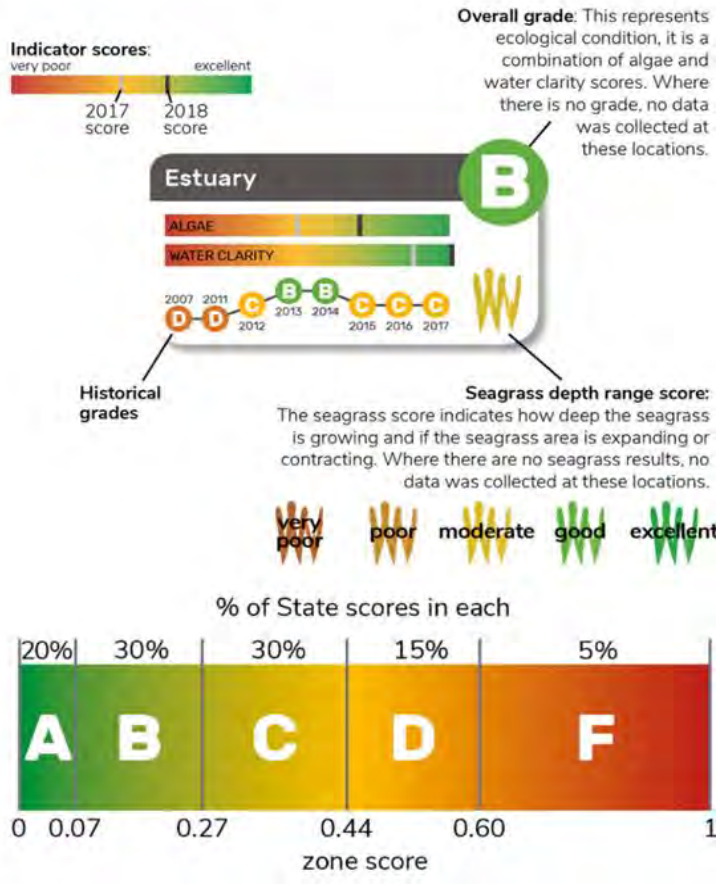

Figure 6-2 Report card zone score evaluation process

NSW Government Manly Hydraulic Laboratory Water Quality Stations

Manly Hydraulic Laboratory operate a range of water quality monitoring stations across NSW with two (2) located in the MidCoast LGA, in the Myall Lakes estuary system, as per Table 6-3:

Table 6-3 MHL water quality monitoring sites

Site Name	Station ID	Easting (m)	Northing (m)	Coverage
Bombah Point	209475	434678	6403307	2001 - Present
Tea Gardens	209480	421725	6385110	2008 – Present

6.3.2 Water Level Monitoring

In conjunction with the water quality monitoring, Manly Hydraulics Laboratory also operate an extensive range of physical data monitoring stations across the MidCoast LGA, including six (10) estuarine water level gauges and three (3) ocean tide gauges. Seven (7) of these gauges are located within the study area, as per Table 6-4

Table 6-4 MHL Water Level Monitoring Sites

Estuary	Site Name	Station ID	Easting (m)	Northing (m)	Coverage
Karuah	Karuah	209485	403407	6386501	2009 - Present
Myall Lakes	Bombah Point	209475	434678	6403307	2001 - Present
	Tea Gardens	209480	421725	6385110	2008 – Present
Smiths Lake	Tarbuck Bay	209465	451545	6417903	1996 - Present
Wallis Lake	Pacific Palms Wharf	209406	455400	6422554	2016 - Present
	Tuncurry Downstream	209401D	450364	6441819	2018 - Present
	Forster	209402	453635	6440172	1970 - Present

MidCoast Council also manage a small number of upper catchment waterway flood gauges across the LGA, in partnership with the Bureau of Meteorology. This includes one (1) gauge in the Wallis Lake catchment and one (1) in the Myall Lakes Catchment – as listed in Table 6-5

Table 6-5 BoM Water Level Monitoring Sites

Estuary	Site Name	BoM Station ID	Easting (m)	Northing (m)
Wallis Lake	Wallamba River at Nabiac	560048	436832.31	6446432.63
Myall Lakes	Myall River at Bulahdelah	560040	425443.73	6413408.57

6.3.3 Citizen Science Programs

Waterwatch is a long running school and community-based water quality monitoring program. Primary schools, high schools, community groups, landholders and other community volunteers can participate in the Waterwatch program. The data they collect is used as an indicator of total catchment health (Waterwatch, 2020). The Waterwatch dataset includes physical and chemical parameters collected during the period from 1990 to 2021 collected monthly by trained volunteers. They also collect aquatic macro-invertebrates (water bugs), and site characteristics (through site assessments).

6.4 Challenges and Opportunities for Estuary Management

6.4.1 Funding and Resources

As a regional Council, the MidCoast LGA has a relatively low population density relative to the size of its coastal and estuary foreshore/assets. The LGA therefore has a limited ratepayer base with which to fund the implementation of coastal management actions – and the funding provided for coastal management is typically weighed against the many other competing demands on Council as a service provider to its community. As a result, Council is generally limited by the funding and resources (such as staffing) available and is often reliant on other sources of revenue such as state government grants and subsidies. Nonetheless, it should be noted that Council has instituted an environmental rate dedicated to staffing and grant funding for actions in strategies they have developed.

Engagement with key stakeholders in Stage 1 identified that this lack of funding has hindered research to understand key issues affecting the study area – and to employ large scale strategic responses. Furthermore, funding and resource constraints have resulted in the need to stringently prioritise and schedule coastal and estuary management actions across the LGA, with implementation typically undertaken on an ad hoc basis as funding becomes available (rather than through a more strategic approach). As discussed in Section 6.2, around 19% of all actions outlined in the existing CZMPs, EMPs and CMPs have not commenced or are outstanding (despite being around 10 years old), and this resource strain was identified by stakeholders as a major contributor to delayed uptake of actions.

Therefore, the NSW Coastal Reforms (and the implementation of CMPs) represents an opportunity to improve the funding and resources available for estuary management through the following mechanisms:

- The CMP can unlock funding made available through the NSW Coastal and Estuary Grants Program. In fact, future grant funding for the implementation of management actions will *require* councils to have a certified CMP. This is discussed further in Section 10.2.
- The development of management actions in Stages 3 and 4 of the CMP will be prioritised by a strong understanding of community values and a rigorous cost-benefit analysis. The CMP can develop a clear and succinct forward program of staged priority actions that are supported and ranked by a robust business case - as opposed to a more aspirational “wish-list” style of plan that is unwieldy and/or difficult to implement efficiently.
- The CMP will clearly outline how actions will be implemented through Council’s IP&R framework, including Council’s Delivery Program and Operational Plan. This will assist in obtaining internal Council funding for actions by ensuring that financial requirements are adequately linked with Council’s budgeting and resourcing mechanisms.

The funding issues outlined above generate strain on resources that are required to ensure proper compliance with existing rules and regulations. Many stakeholders identified inadequate regulation and a lack of compliance effort as a major challenge for effective management of the estuaries (this is discussed further in “Key Issues” in Section 8.5). This issue generally pertains to illegal dumping and pollution of the waterways, adherence to development controls, and anti-social behaviour on the waterways from recreational boating. It is anticipated that the CMP can facilitate a more coordinated approach to compliance regulation.

6.4.2 Population Growth

Population pressures have also been identified as a significant challenge to coastal management across the study area, and the LGA more generally. While the MidCoast LGA is expected to experience population growth on par with the state average over the next 15 years, it should be noted that some localised area will experience significantly higher growth. These pressures will manifest themselves in a number of ways over management timeframes.

Development pressure and urbanisation will have significant impacts on quantity and quality of urban runoff and industrial discharge into the receiving waters of the upper estuary impacting on water quality. Section 4.7 shows that some major residential developments are planned to impact upon estuary foreshores and catchments, particularly around Forster and Tea Gardens/Hawks Nest.

These population pressures will increase demand for recreational use of the waterways (particularly across the Wallis Lakes system), leading to recreational use conflicts. These pressures are also exacerbated by the increasing role of the MidCoast area tourism destination, particularly major urban centres within relatively close driving proximity such as Sydney and Newcastle. These pressures currently manifest during peak holidays periods, however this issue will place additional strain on the area over coming timeframes.

High touristic use can also at times result in conflicts in values, priorities, and understanding of coastal management issues between permanent residents and more transient recreational users of the coastal zone.

6.4.3 Coordination amongst stakeholders

As discussed in Section 7.1, the governance of these estuaries is multi-layered and complex - with the catchments, foreshores, and waterways of the study area managed by a range of public authorities across multiple levels of government. Consequently, another major barrier identified by the project stakeholders was the lack of coordination across these governance bodies.

This lack of coordination inhibits a consistent and effective approach to coastal management, hinders knowledge and data sharing, and impedes the development of a higher level of understanding of the interconnected nature of the larger, system-scale pressures.

The stakeholder engagement workshop also revealed that there is a lack of understanding of the objectives of the various land managers across the study area (including Council, DPE (E&H), DPE-Crown Lands, DPI-Fisheries, LLS, and NPWS), and at times competing objectives and priorities that represent a barrier to the coordinated and effective management of the coastal zone. A result, there is a significant amount of jurisdictional ambiguity between stakeholders.

Therefore, the CMP process should be undertaken with a vision of establishing pathways and processes for improved coordination and a consistent overarching direction across the various bodies managing the coastal zone. Section 7.1 provides a CMP governance structure that intends to provide these channels for communication and information sharing. It is anticipated that increased coordination in this area could ensure that the roles, responsibilities and objectives of the various land managers across the catchments and estuaries are clearly defined and well understood by stakeholders and the community – so that jurisdictional ambiguity is reduced.

6.4.4 Information Gaps

Many of the project stakeholders noted that there are many areas where additional knowledge is required to support a better understanding of longer-term issues and risks - and to provide a sound basis for informed decision making. These knowledge gaps relate to a number of environmental, social and economic information categories. The CMP represents an opportunity to establish a collaborative approach to knowledge sharing across organisations, and to coordinate and implement data collection and the commissioning of system-wide studies and monitoring programs to fill knowledge gaps.

7 ROLES AND RESPONSIBILITIES

7.1 CMP Governance Structure

The stakeholder engagement activities undertaken as part of this Scoping Study demonstrated significant support for the development of a CMP that represents the management interests of a broad range of Local and State government agencies.

The NSW Coastal Management Manual Part B, Stage 1 (OEH, 2018a) requires that governance arrangements be established, not only for Stage 1 of the CMP, but also for the subsequent stages. The NSW Coastal Management Framework provides for some flexibility around the structure and governance arrangements of a CMP. As discussed in Section 1.3, a CMP is intended to help local councils and their communities to identify and manage risks to the environmental, social and economic values of the coast.

With this in mind, a dedicated project lead/Manager should be appointed for this CMP development from within MidCoast Council. It is recommended that Council will retain ownership of the process and be responsible for day-to-day management of the CMP. This will include:

- Decision making throughout the CMP, and ensuring delivery of project outcomes;
- Day-to-day project management of the CMP;
- Managing budgets and financial transactions for the project;
- Reporting on financial and project progress;
- Organising events and other parts of the community and stakeholder engagement plan;
- Monitoring the performance of the project and reporting;
- Regular liaison with the consultant(s) to monitor performance; and
- Responding to any enquiries about the project from stakeholders and communities.
- Provision of input into the technical aspects of the project;
- Exchanging information and data where relevant and available; and
- Informing and supporting decision making with regards to technical and managerial matters.

Development and implementation of the CMP will require engagement and coordination across a range of relevant agencies and organisations. Therefore, it is imperative that the CMP governance structure foster and facilitate collaboration across these agencies to optimise outcomes.

To this end, a recommended governance structure for the CMP is provided in Figure 7-1. It is recommended that the project is overlooked and managed by a Project Lead who will be supported by of the various stakeholder groups which include:

- The Southern Estuaries CMP Reference Group,
- Southern Estuaries CMP Technical Working Group,
- Southern Estuaries CMP MCC Internal Working Group.

Information on the members to be included in each group are listed in the Engagement Strategy in Appendix A.

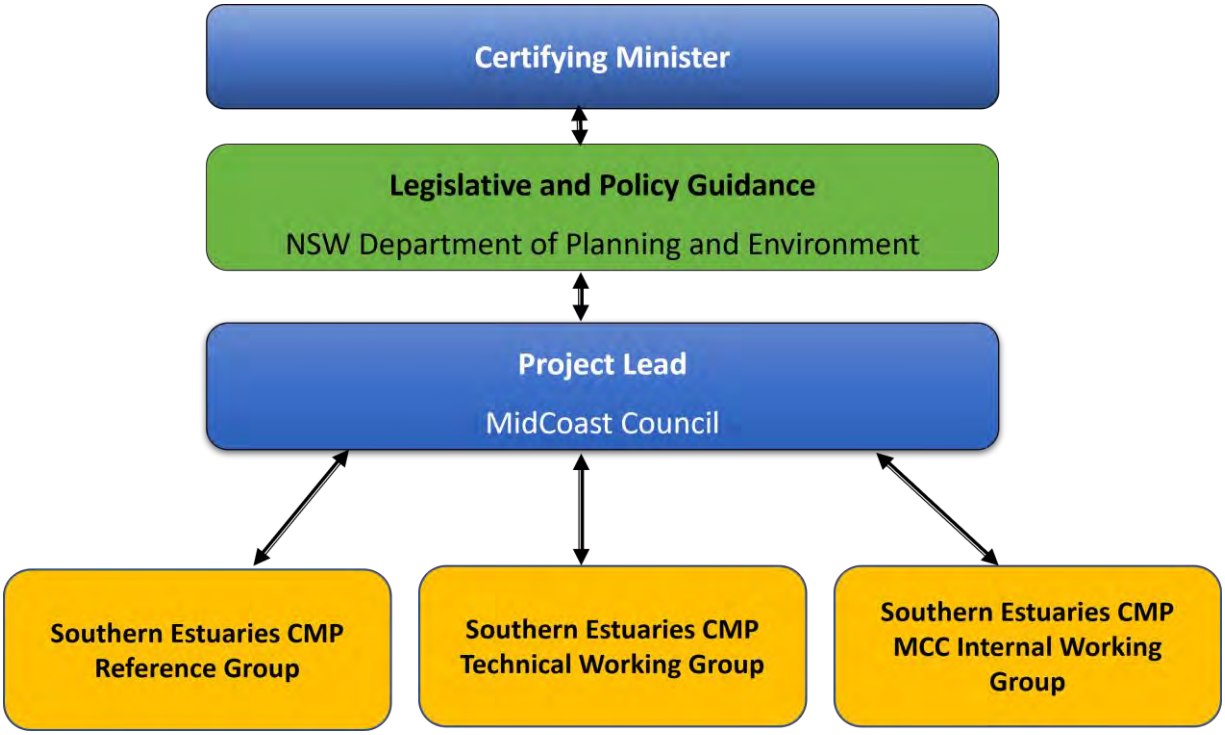

Figure 7-1 Proposed CMP Governance Structure

The suitability of the governance structure should be reviewed at least after each CMP stage and changes made if deemed appropriate by the Project Lead. Therefore, the make-up of the governance structure should be considered flexible, with the potential inclusion of additional organisations as the CMP progresses, and as future governmental department changes may dictate.

8 FIRST PASS RISK ASSESSMENT AND KEY ISSUES

8.1 Methods and Limitations

Section 21 (3) (b) of the CM Act requires the application of a risk management process when preparing CMPs and identifying where management actions are required (OEH, 2018a). To this end, a review has been undertaken to identify the environmental, social and economic values of the estuaries and to assess the various threats and pressures which may affect these values.

This has included the following components:

- Assessment of community uses and values – see Section 8.2
- Identification of study areas threats and stressors – see Section 8.3; and
- Analysis of the level of risk presented by those threats in a first-pass risk assessment (FPRA) – see Section 8.4.

The high-level qualitative FPRA has been undertaken in accordance with the requirements set out in the NSW Coastal Management Manual. This assessment is essentially a tool for the prioritisation of risks, to identify those that need to be further assessed in subsequent stages of the CMP. It should be noted that this is intended as a broad scale, semi-qualitative assessment – and should be refined and developed in significantly greater detail during Stage 2 of the CMP.

Key issues identified by the FPRA are discussed in Section 8.5

8.2 Values

As part of this Scoping Study, a review was undertaken of the community uses and values of the study area. This was undertaken through two mechanisms.

- Review of historical community and stakeholder engagement activities across the study area; and
- The application of community engagement for this Scoping Study (Stage 1 of the CMP) in the form of an online community survey. The results of this engagement are summarised in Section 5.5.7.

Firstly, a review was undertaken of historical community and stakeholder engagement activities across the study area (See Section 5.5). There have been a significant number of community and stakeholder engagement exercises undertaken across the study area over the last 15 years designed to ascertain community values and uses of the catchment, coastal zone and marine estate. These have been undertaken by multiple tiers of government to inform a range of different plans and strategies.

Secondly, a contemporary assessment of community values was undertaken through the application of on an online community survey (Section 5.5.1 and 5.5.7).

A summary of responses from the survey: "*What words or phrases would you use to describe what you value about these estuaries?*" is provided in Figure 8-1 in the form of a word cloud. Descriptors including "beauty", "natural", and "biodiversity" were common across the respondents - indicating the high importance that the local community places on the natural environment of the area. Furthermore, words such as "places", "family" and "swimming" and "activities" were also common, indicating the high recreational and social values that the estuaries provide to the MidCoast Community.

Additionally, Table 8-1 summarises community responses to Question 5, asking "*When you think about these three estuaries generally, how important are the following values to you?".* It shows that biodiversity, water quality, recreational amenity, cultural heritage and research and education are highly valued by the local community.

A brief overview of relevant community values is provided in Table 8-1 . The values listed should be considered as a starting point that will be expanded upon during subsequent stages of the CMP. Figure 8-2 and Figure 8-3 present values that best represent the ideal state of Wallis and Smiths Lake from engagement with coastal and estuary committee.

Figure 8-1 A Word Cloud Depicting Community Values

Figure 8-2 A Word Cloud depicting the Coast and Estuary Committee Values for Wallis Lake

Figure 8-3 A Word Cloud depicting the Coast and Estuary Committee Values for Smiths Lake

Table 8-1 Values of The MidCoast Southern Estuaries

Category	Value	Description (and relation to community survey questions)
Environ-mental Values	Healthy Ecosystems	Healthy ecosystems very clearly ranked as the most important value amongst the community for various sites within the study area. This indicates that the MidCoast Southern estuaries are highly valued for the healthy and diverse ecosystems they contain. There is a diversity of habitats for a range of terrestrial and aquatic species, including many protected under State and Commonwealth legislation.
	Water Quality	Water quality very clearly ranked as the second most important value amongst the community for each of the estuaries. This shows that estuarine water quality is highly valued and considered a general indicator of estuary and catchment health by the community. The value of water quality extends to maintaining or improving the ecological condition of waterbodies, visual amenity, primary and secondary contact recreation.
Social and Cultural Values	Scenic Amenity	Scenic amenity ranked as the third most important value, and the word cloud depicted in Figure 8-1 shows that the natural character of the study area is an essential component of community benefit.
	Social and Recreational Amenity	Recreational amenity ranked as the fourth most important value. This indicates that the foreshore areas and waterways of the estuaries are highly valued by locals and visitors alike for the social and recreational amenity values that they provide. At Wallis, Smiths and Myall Lakes this was equally important. The most popular activities include walking (exercise), nature observation, relaxation, swimming, and watercraft activities.
	Cultural Heritage	The southern estuaries have a rich and continuing Indigenous heritage, high cultural and spiritual significance to Traditional Owners and the broader community – both in terms of its ongoing importance to communities and because of the links to the Traditional Owners of the area. This ranked as the fifth most important value.
	Research and Education Value	This ranked as the sixth most important value. The estuaries are a valuable asset for research and education. The Wallis and Smiths Lake have facilitated important research by University of Newcastle, University of New South Wales and Macquarie University, and provide opportunities in the study of marine science and management for both students and researchers. Research of these estuaries have been undertaken by DPE Science group.
Economic Values	Economic Prosperity	Wallis, Smiths, Karuah, North Arm Cove estuaries are a significant economic resource that provide direct economic value through supporting industries such as Oyster aquaculture, commercial fishing, tourism – which is a major contributor to the regional economy. As discussed in Section 4.5.2, the estuaries also provide indirect economic value in the form of their ecosystem services.

The Department of Planning & Environment is currently undertaking comprehensive stakeholder engagement to identify community values for water quality objectives on the east coast of NSW, and the results will be incorporated into the CMP.

8.3 Threats

Threats to community benefits arise from a range of stressors, and can have impacts on the environmental, social and economic values of the study. The various threats and stressors have been identified through stakeholder engagement, a review of previous coastal and estuary studies and management plans, and the Marine Estate Management Strategy Threat and Risk Assessment (MEMS TARA) (BMT WBM, 2017), and the FPRA has drawn upon findings of the MEMS TARA in this assessment.

Based on this preliminary review, a total of 56 threats has been initially provided, across five (5) threat categories. A brief overview of the various study area threats is provided in Table 8-2, which also provides an outline of the potential environmental and socioeconomic impacts of these threats.

Table 8-2 Summary of Threats

Threat	Stressor Category	Stressor (and Stressor ID)	Environmental Impacts	Social and Economic Impacts
Coastal and Estuarine Hazards	**Long Term Hazards**	1.1 Tidal inundation of estuaries (i.e., "sunny day flooding") 1.2 Estuary foreshore erosion and bank instability 1.3 Estuary entrance instability	▪ Shoreline and bank erosion can affect foreshore biodiversity ▪ Rising sea levels generate "habitat squeeze", with a need to accommodate for landward migration of marine vegetation communities ▪ Increased pressure to provide built 'defences' including revetment walls, levees and drainage infrastructure to maintain current land uses ▪ Potential impacts of construction and operation of sea level rise defence measures (e.g., habitat impacts, prevention of landward migration of marine vegetation communities, and water quality issues associated with drainage of ASS) ▪ Bank erosion can cause increased sedimentation of the waterway and affect benthic/riparian habitat ▪ Sand movement changing navigational channels and water flow/circulation	▪ Inundation of low-lying foreshores during king tide events can affect social and recreational amenity ▪ Ingress of tidal inundation to low lying communities can affect access and public safety and threaten assets and infrastructure ▪ Long term shoreline recession and estuary bank erosion can affect recreational and social amenity through reduction of open space ▪ Long term shoreline recession and estuary bank erosion can threaten and undermine foreshore assets and recreational access ▪ Economic and social impacts associated with environmentally beneficial land use/zoning changes to lowest parts of floodplain ▪ Economic impacts associated with changing navigational channels, shoaling, water flow and circulation affecting the operation/ function of commercial activities
	Event Based Hazards	2.1 Coastal storm impacts - erosion 2.2 Coastal storm impacts - inundation 2.3 Combined coastal and catchment flooding 2.4 Bushfire (including resultant water quality impacts) 2.5 Drought 2.6 Tsunami	▪ Catchment flooding can transport pollutants into the estuary system ▪ Bushfire may result in loss of habitat and biodiversity in the short to medium ▪ Run-off, erosion and biodiversity impacts of bushfire events ▪ Coastal erosion may result in loss of dune habitat, and seabed deposition can affect seagrass and benthic habitat and biodiversity in the short term ▪ Droughts can affect salinity in the upper catchment, environmental flow in urban creeks, loss of macroinvertebrates and riparian vegetation that requires freshwater ▪ Droughts and periods of low flow can increase potential for algal blooms and fish kills in smaller tributaries. More relevant to non-tidal areas, but may affect downstream systems.	▪ Coastal erosion and inundation during storm events are a threat to foreshore assets on private and public land, foreshore access, and social and recreational amenity values ▪ Catchment flooding affects low lying infrastructure, private property, and environmental assets, and represents a significant risk to public safety, particularly for ICOLLs ▪ Catchment flooding may also impact commercial infrastructure (eg oyster racks). Post flood – amenity, reserve and infrastructure use and debris can affect safety. ▪ Significant rainfall events may also affect commercial operations (eg large rainfall events may impact oyster harvesting regimes etc) ▪ Bushfires represent a huge public safety risk and can affect recreational amenity values ▪ Tsunami, whilst rare, can significantly affect maritime assets and infrastructure and low-lying land, and represent a serious risk to public safety ▪ Drought/ dry creeks have impacts on social and recreational amenity values (fishing, walking/hiking)
	Climate Change Impacts	3.1 Ocean/estuary temperature increase 3.2 Altered storm frequency and severity 3.3 Altered hydrological regimes 3.4 Sea level rise 3.5 Long term shoreline recession due to sea level rise 3.6 Altered salinity levels / profile 3.7 Habitat migration and squeeze	▪ Sea level rise and rainfall impacts will affect coastal and estuarine processes and dynamics – including erosion ▪ Increased flood severity may negatively impact water quality on terrestrial (riparian), aquatic and marine coastal ecosystems ▪ Altered rainfall regimes may affect the baseline hydrology of the upper catchment, and the opening and closing regime of the estuary entrance ▪ Landward migration of coastal wetlands will occur in response to sea level rise. However, coastal development will form a barrier to wetland migration in some areas, resulting in habitat squeeze ▪ Salinisation of groundwater habitats and impact on groundwater dependent ecosystems ▪ Changes in the distribution of biodiversity, including pest species such as Cane Toads	▪ Sea level rise is likely to significantly affect low lying coastal communities in terms of their susceptibility to tidal inundation, coastal inundation and catchment flooding. This can result in damage to public and private infrastructure, and may increase the home insurance for such flood prone properties. ▪ Sea level rise may result in an upwards and landward migration of the entrance berm – resulting in higher mean and peak water levels in the ICOLLs ▪ Increases in heavy rainfall events are expected to increase the likelihood of flooding in the ICOLLs ▪ Increased frequency and severity of storm and erosion events will result in economic costs as well as implications for socialisation and sense of community ▪ Climate change impacts on marine and estuarine ecology will affect recreational use of the estuary system and non-use values (such as bequest values) ▪ Climate change stressors such as sea level rise and increased sea temperatures can negatively impact cultural heritage ▪ Salinisation of groundwater resources may impact on agricultural activity
Urbanisation and Land Use Impacts	**Water Pollution and Sediment Contamination**	4.1 Urban stormwater and Industrial discharges 4.2 Sewage effluent and septic runoff 4.3 Agricultural runoff	▪ Water pollution – through nutrients and organic matter, toxic contaminants, sediments, pathogens and marine debris including microplastics, litter and solid waste	▪ Water pollution due to stormwater and sewer discharges, agricultural runoff and industrial discharges can impact health, safety and wellbeing

Threat	Stressor Category	Stressor (and Stressor ID)	Environmental Impacts	Social and Economic Impacts
		4.4 Sediment contamination / pollution (including ASS)	▪ Contribution to proliferation of algal blooms and aquatic weeds ▪ Impacts on aquatic ecology ▪ Water pollution and contamination through disturbance of acid sulfate soils	▪ Pathogens also represent a serious threat to oyster aquaculture, as oysters are filter feeders and have the potential to concentrate human pathogens. ▪ Public health can be impacted as sewage contaminated waters may contain life- threatening human pathogen such as cholera, typhoid, dysentery etc ▪ Loss of amenity associated with pollution is likely to significantly impact people's relationship with the coast and their ability to appreciate marine biodiversity ▪ Local businesses that are dependent on the coastal zone for their viability, such as tourist operators, may experience major impacts on viability due to events such as closures and fish kills ▪ Water pollution can impact on tangible Aboriginal cultural heritage including damage to places of significance
	Habitat Disturbance	5.1 Foreshore / urban development 5.2 Clearing / disturbance of riparian and aquatic habitat 5.3 Clearing / disturbance of littoral rainforest habitat 5.4 Clearing / disturbance of terrestrial habitat 5.5 Introduction of invasive fauna pest species 5.6 Introduction of invasive flora pest species (e.g., aquatic weeds) 5.7 Damage, loss or disturbance of indigenous heritage (tangible or intangible) 5.8 Damage, loss or disturbance of non-indigenous heritage	▪ Physical disturbance resulting from shoreline infrastructure, sediment re-suspension and shading resulting in light limitation, sediment deposition ▪ Wildlife disturbance through pollution and habitat loss ▪ Introduction of pest species can have negative impact on habitats and protected species ▪ Threats to species of conservation significance and overall biodiversity of the coast zone ▪ Clearing terrestrial vegetation results in increased runoff of sediment into the upper estuary	▪ Environmental impacts may reduce recreational amenity and social enjoyment of environmental values ▪ Impacts on people's relationship with the estuaries (e.g., loss of appeal due to decline in wildlife and depreciation of visual character) will also impact social connections ▪ Habitat (physical disturbance) from human activity can impact on Aboriginal cultural heritage
	Hydrologic Modifications	6.1 Increasing use of groundwater 6.2 Modified freshwater flows, including water extraction 6.3 Catchment based sedimentation 6.4 Estuary Delta Migration 6.5 Estuary entrance management and modification 6.6 Dredging	▪ Natural hydrology altered through unsustainable surface and groundwater extraction ▪ Changes to hydrological regime can affect habitat and biodiversity ▪ Sedimentation impacts on seagrass ▪ Frequent entrance openings can affect the natural opening and closing regimes of the estuaries, and have resultant impacts on estuarine ecology	▪ Sedimentation can reduce water depth in the estuary, negatively affecting recreational use of the waterways ▪ Turbidity associated with dredging can negatively affect recreational amenity ▪ Modified freshwater flows can impact recreational fishing and Aboriginal cultural heritage, by negatively affecting fish stocks
Resource Use and Conflict	**Commercial Fishing**	7.1 Overfishing	▪ Overfishing and bycatch could result in decline of fish stocks and ecological diversity ▪ Could impact breeding stocks ▪ Reduction in abundances of species and trophic levels ▪ Bycatch ▪ Incidental catch of species of conservation concern ▪ Wildlife disturbance (shorebirds, turtles, Wales) ▪ Physical disturbance through interaction with fishing gears ▪ Marine debris ▪ Ghost fishing	▪ Unsustainable fishing limits the future productivity of commercial fishing ▪ Economic impacts associated with function/ operation of commercial industries (oyster growers) ▪ Loss or decline of revenue ▪ May impact the trophic food chain.
	Recreational Fishing	7.2 Unsustainable fishing practices (boat and shore based)	▪ Water pollution – contaminants released into the waterway through antifouling paint and oil spills, and effluent disposal ▪ Physical disturbance (i.e., seagrass) resulting from recreational use and shoreline infrastructure ▪ Reduction in abundances of species and trophic levels ▪ Bycatch ▪ Incidental catch of species of conservation concern ▪ Wildlife disturbance (shorebirds, turtles, Wales) ▪ Physical disturbance through interaction with fishing gears ▪ Marine debris ▪ Ghost fishing	▪ Unsustainable fishing limits the future productivity of both recreational (social) fishing

Threat	Stressor Category	Stressor (and Stressor ID)	Environmental Impacts	Social and Economic Impacts
	Recreation and Tourism	7.3 Passive Recreational Use 7.4 Anti-social behaviour and unsafe practices (boating, water skiing, wakeboarding and 4WD access)	▪ Uncontrolled pedestrian access to the waterways can generate or exacerbate bank erosion (including resultant loss of foreshore biodiversity) ▪ Physical disturbance (i.e., seagrass) resulting from recreational use and shoreline infrastructure ▪ Reckless 4WD driving can result in large areas of saltmarsh being damaged	▪ Environmental impacts may reduce recreational and social amenity ▪ Recreational pressures on the system may impact amenity and therefore people's enjoyment and relationship with estuarine environmental values
	Access and Availability	8.1 Overcrowding / congestion of waterways and user group conflict 8.2 Overcrowding / congestion of foreshores/beaches and user group conflict 8.3 Limited or lack of foreshore and waterway access	▪ Overcrowding of foreshores can result in disturbance of riparian and adjacent habitat ▪ Disturbance of fauna through noise and vessel strike	▪ Overcrowding / congestion reduces the recreational and social amenity of the system, resulting in "loss of appeal" ▪ Tangible and intangible Aboriginal cultural heritage is impacted by conflict over resource access and use ▪ Continued and ongoing incidents of anti-social behaviour are likely to deter community use of the marine estate
Public Health and Safety	**Public Health and Safety**	9.1 Water pollution/contamination affecting human health and safety – including algal blooms 9.2 Safe navigable waterways- entrance bar 9.3 Public safety risk from aging and/or degraded coastal/estuary infrastructure 9.4 Wildlife interactions (sharks, blue-ringed octopus etc)	N/A	▪ Wave overtopping of coastal structures can represent a safety hazard to the general public ▪ Energetic coastal processes represent a significant safety risk to local users, particularly in the form estuary entrance currents during opening or flooding ▪ Wildlife interactions can threaten life and safety. Media and news coverage can have a negative impact on recreational use
Planning and Governance	**Governance**	10.1 Lack of adequate coordination between Council and state government agencies – and jurisdictional ambiguity 10.2 Lack of compliance with regulations (by users) or lack of regulation effort (by agencies) 10.3 Lack of funding for investigation and action implementation 10.4 Lack of or ineffective community engagement or participation in governance	▪ Lack of compliance with water management regulations across the upper catchment can result in excessive nutrient and sediment loads entering the estuaries ▪ Lack of compliance with water extraction allotments and the conditions of water access licences (WALs) can result in overextraction of surface and groundwater from across the catchment, and affect the volume and intensity of freshwater environmental flows in the estuaries ▪ Inadequate enforcement of regulations can result in reduced compliance rates with the above issues	▪ Ambiguity regarding roles and responsibilities of the various agencies dealing with the estuary and catchment create inefficiencies with regard to management and approvals processes ▪ Environmental impacts may reduce recreational and social amenity and enjoyment of environmental values
	Information Gaps	11.1 Incomplete coastal and estuary process information (including climate change impacts) 11.2 Incomplete ecological information (including climate change impacts) 11.3 Inadequate and/or incomplete European and Indigenous Heritage information 11.4 Inadequate social and economic information	▪ Lack of adequate information hampers the implementation of effective management strategies and plans	▪ The cumulative impacts of socio-economic threats are an area that has received limited research attention to date, and this is recognised as a current data gap in the TARA process ▪ There is a knowledge gap around the views and aspirations of Aboriginal people in regard to the NSW marine estate, and this may affect the cultural and heritage amenity of the area

8.4 First Pass Risk Assessment

The risk assessment has been undertaken for the list of threats affecting the environmental, social and economic values of the coastal zones outlined in Section 8.3. The assessment has been undertaken in a systematic fashion, in accordance with the following National risk standards and guidelines:

- ISO 31000:2018, Risk management – Principles and guidelines, provides principles, framework and a process for managing risk and
- AS 5334:2013 Climate change adaptation for settlements and infrastructure – a risk-based approach.

The assessment process was systematic and involved application of qualitative scales of likelihood and consequence. The scales of likelihood and consequence adopted for this assessment have been modified from the MEMA TARA (BMT WBM, 2017) and to those set outlined by the MidCoast Council Guidelines (MidCoast Council, 2020c) to provide consistency with that wider assessment.

Table 8-3 Consequence Definitions, adapted from MidCoast Council Guidelines

Consequence	Definition
Insignificant	A: Appearance of a threat but no actual harm B: Minor shortfall relative to current forecasts C: There would be minor areas in which the region was unable to maintain its current services D: No environmental damage E: There would be minor instances of public administration being under more than usual stress, but it could be managed
Minor	A: Serious near misses or minor injuries B: Individually significant but isolated areas of reduction in economic performance relative to current forecasts C: Isolated but noticeable examples of decline in services D: Minor instances of environmental damage that could be reversed E: Isolated instances of public administration being under severe pressure
Moderate	A: Small numbers of injuries B: Significant general reduction in economic performance relative to current forecasts C: General appreciable decline in services D: Isolated but significant instances of environmental damage that might be reversed with intensive efforts E: Public administration would be under severe pressure on several fronts
Major	A: Isolated instances of serious injuries or loss of life B: Regional stagnation such that businesses are unable to thrive, and employment does not keep pace with population growth C: Severe and widespread decline in services and quality of life within the community D: Severe loss of environmental amenity and danger of continuing environmental damage E: Public administration would struggle to remain effective and be seen as in danger of failing completely

Consequence	Definition
Catastrophic or Severe	A: Large numbers of serious injuries or loss of lives B: Regional decline leading to widespread business failure, loss of employment and hardship C: Region would be seen as very unattractive, moribund and unable to support its community D: Major widespread loss of environmental amenity and progressive irrecoverable environmental damage E: Public administration would fall into decay and cease to be effective
A= Public Safety; B= Local economy & growth; C= Community & lifestyle; D= Environment & sustainability E= Public administration.	

Table 8-4 Likelihood Definitions, adapted from MEMA TARA (BMT WBM, 2017)

Likelihood	Definition
Rare	Recurrent risk: Unlikely during the next 25 years Single event: Negligible: probability very small, less than zero
Unlikely	Recurrent risk: May arise about once in 25 years Single event: Unlikely but not negligible: probability noticeably greater than zero
Possible	Recurrent risk: May arise about once in 10 years Single event: Less likely than not but still appreciable: probability less than 50% but still quite high
Likely	Recurrent risk: May arise about once per year Single event: As likely as not: 50/50 chance
Almost Certain	Recurrent risk: Could occur several times per year Single event: Probability greater than 50%

Based on the delineation of likelihood and consequence, a risk rating has been provided based on the risk matrix in Table 8-5, which is again consistent with the MEMA TARA (BMT WBM, 2017). The risk ratings are based on a range of technical inputs listed in Section 8.1, including the expert judgement applied by the project stakeholders during the first Stakeholder Engagement Workshop (Section 5.5.4).

It is acknowledged in this Scoping Study that the various threats and stressors are not uniformly distributed across the estuaries of the study area. The first pass-risk assessment provided herein is intended as a broad, first-pass screening to identify the direction and scope of future CMP stages and is not intended to possess the granularity of a detailed, site-specific analysis, which is to be undertaken during Stage 2. Therefore, this first pass risk assessment has an element of subjectivity when considering the overall level of risk when a threat(s) may be relatively localised in nature. Subsequently, the assessment has applied a conservative or worst-case approach, and where a threat may be considered as high risk even for a relatively localised area, it has been given a rating of high risk overall, in order to clearly identify the issues and provide direction and clarity for the remaining CMP stages. This approach has been adopted as the FPRA is intended as an initial screening to identify the need for further studies

Table 8-5 Risk Assessment Matrix, adapted from MEMA TARA (BMT WBM, 2017)

Likelihood → / Consequences ↓	Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Severe (5)	Medium (5)	High (10)	High (15)	Extreme (20)	Extreme (25)

Likelihood → / Consequences ↓	Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Major (4)	Low (4)	Medium (8)	High (12)	High (16)	Extreme (20)
Moderate (3)	Low (3)	Medium (6)	Medium (9)	High (12)	High (15)
Minor (2)	Low (2)	Low (4)	Medium (6)	Medium (8)	High (10)
Insignificant (1)	Low (1)	Low (2)	Low (3)	Low (4)	Medium (5)

For each of the assessed threats, the risk assessment has considered the following factors:

- What are the existing arrangements to address the threat? Specific attention has been given to where these threats have been addressed by previous coastal and estuary management plans identified in Section 6.1. Where threats are addressed by other plans and strategies (such as state-based), they have also been identified.
- Are existing arrangements working? If so, what is the residual risk? A residual risk rating has been provided.
- How will the risk level change over future planning horizons of 20, 50 and 100 years? Particular consideration has been given to the degree of future risk with the impacts of future development, population pressures and climate change.

The results of the first-pass risk assessment are provided in full in Appendix E. High-risk threats and key issues identified by the assessment are discussed in Section 8.5.

The development of the first-pass risk assessment was undertaken with information provided in the NSW Estuary Health Risk model (DPIE 2019). The dataset identifies land-use pressures and consequent risks of impacts on the ecological health of estuaries. The intent of the dataset is to help identify strategic priorities for managing nutrient and sediment runoff throughout a catchment so that estuary health is protected, maintained and/or improved. Risks associated with other pressures, such as acid sulfate soils, erosion and contaminants, are not captured. The dataset can be used to help map where further studies and/or management actions in a catchment would contribute to achieving some of the management objectives for coastal environment areas and coastal wetlands and littoral rainforests areas specified in the Coastal Management Act 2016. Section 8.1.2 summarises range of datasets used for risk assessment used in this study.

8.5 Key Issues

The purpose of this section is to identify and briefly outline the key issues affecting the study area – including existing issues and future emerging issues likely to affect the study area over defined management timeframes. The risk assessment identified 21 high risk stressors which presently affect the study area. A brief snapshot of these stressors is provided in Table 8-6. A key component of this study was also to identify emerging and future stressors to the study area. These are outlined in Table 8-7.

Based on the nature and the scope of the issues identified below, the Coastal Management areas discussed in Section 2.4 are considered to be suitable to address the various stressors to the environmental, social and economic values of the study area. This is particularly the case for high priority issues such as coastal hazards (inducing tidal inundation and bank erosion) and water quality, sedimentation and erosion, and at-risk public infrastructure.

Table 8-6 Overview of High-Risk Stressors

Stressor 1.1 - Tidal Inundation
There are a number of communities around the various foreshores of the study area that are likely to be affected by tidal inundation, or “sunny day flooding”, over future planning horizons to some degree. A high-

level state government assessment (OEH, 2018g) of the total number of affected properties within each catchment is presented in Section 2.4.4. A brief description of residential areas indicated as being potentially affected by tidal inundation under a +1.0m SLR scenario is provided herein (based on mapping provided in OEH (2018g):

- *Wallis Lake:* Much of the land expected to be inundated under both SLR scenarios is urban and agricultural land. This includes developed areas such as the southern parts of both Forster (around Big Island) and Tuncurry (around Wallamba Cove). Under +1.0 m SLR around 8% (1,130 properties) of the total properties in the area are impacted by inundation, with majority of these properties situated in these townships. Under +1.5 m SLR, a further 5% (1,777 total impacted properties) of the total properties experience inundation which is primarily derived from further inundation of these already impacted areas.
- *Smiths Lake:* Most properties surrounding Smiths Lake remain relatively unimpacted with only 5% (66) properties impacted under +1.5 m SLR. The greatest impact of inundation is experienced in the Tarbuck Bay area, where The Lakes Way Road is significantly inundated, and the Sandbar/Cellito Beach area.
- *Myall Lakes:* Overall, there are only small areas of developed land impacted by inundation in this area due to the large amounts of National Park and nature reserve directly adjacent to much of the Myall Lakes and River. Despite this, the areas of development that are affected make up a large portion of the public and private properties in this catchment and thus significant proportions of these properties are affected by inundation. Approximately 12% (586) of properties are impacted under +1.0 m SLR which increases to 25% (1180) of properties under +1.5 m SLR. The most significantly impacted areas are Tea Gardens and Hawks Nest in the Lower Myall River estuary with nearly half of Tea Gardens becoming inundated under +1.5 m SLR.
- *Port Stephens/Karuah River:* There is localised impact on property on both the northern shore of Port Stephens and Karuah River with only 8% of properties in both areas being impacted by inundation under +1.5 m SLR. The most impacted area on the north shore of Port Stephens is Pindimar around the Pindimar South Reserve while in Karuah River the impact is distributed along the shoreline.

Ecological impacts of tidal inundation, which will cause significant transformation of ecological communities and loss of biodiversity, especially where there is no area available for ecosystem migration.

Stressor 1.2 Coastal Storm impacts - erosion

The majority of the study area estuaries are protected from the impacts of coastal storms by headlands, coastal dunes and breakwaters (i.e., Wallis and Smiths Lake). However, the outer Karuah/ Port Stephens estuary is dominated by tidal and wave processes and is exposed to coastal storms and erosion.

The Lower Pindimar, Pindimar, Upper Pindimar and Bundabah Foreshore Erosion Study (BMT WBM , 2010) investigated foreshore erosion issues along these shorelines and found that these low-lying coastal township possess a high level of coastal erosion risk.

Coastal erosion can negatively impact the environment, as well as recreational amenity of these beaches and threaten aboriginal heritage by exposing cultural sites. Steep erosion scarps can also make public beach access unsafe.

Stressor 2.2 - Coastal inundation

Coastal inundation is flooding of coastal lands by ocean water. The risk increases when there are high ocean levels due to storm activity combined with high astronomical tides. The risk will be further exacerbated over coming decades by ongoing sea-level rise.

While the majority of the study area is protected from coastal inundation, water levels in Port Stephens are influenced by both water levels within the estuary and offshore wave climate. Foreshore inundation around Port Stephens will depend on a combination of water levels in the estuary, wind waves, ocean wave activity, inshore bathymetry and the presence of foreshore structures (Umwelt, 2009).As waves reach the shoreline, they break and the remaining energy dissipation results in wave run up, which can cause inundation of foreshore areas. Inundation in the foreshore areas could impact the ecological communities due to coastal squeeze and loss in biodiversity.

Manly Hydraulics Laboratory (Manly Hydraulics Laboratory, 1997) examined the wave runup and flood levels around the Port Stephens foreshore. The study found that ocean waves tend to primarily impact the eastern embayments of Port Stephens, and that the highest waves were caused by easterly winds pushing waters directly into Port Stephens.

The Draft Port Stephens Foreshore (Floodplain) Risk Management Study and Plan (FRMSP) Review (BMT WBM, 2020a) states that there is little qualitative or quantitative coastal flood history information for the area. The Port Stephens Foreshore (Floodplain) Management Plan (WMAwater, 2002) put out a community survey on coastal flooding and found there were 10 properties anecdotally experiencing above floor flooding, three (3) of which were flooded by the estuary. An additional 60 residents reported inundation of yards, which may be from tidal and wave inundation. however only some of these reports were attributed to tidal and wave inundation.

The Draft Port Stephens FRMSP Review modelled the design flood events accounting for 0.55 m of sea-level rise by 2050 and 0.91 m of sea-level rise by 2100. It identified the following areas as being subject to wave runup flooding based on design wave runup depth maps under current and future planning horizons:

- Tahlee
- Carrington
- North Arm Cove
- Bundabah
- Pindimar

In particular, Carrington and Tahlee are subject to extensive foreshore flooding under a range of design SLR conditions. Under the design 1% AEP scenario, the towns become inundated by depths greater than 1.0 m. By 2100, flood extents and depths increase for the increase to depths greater than 1.5 m.

Stressor 2.3 - Combined coastal and catchment inundation

Flooding in tidal waterways can be caused by catchment flooding, elevated ocean conditions, or a combination of the two. The influence of flooding from each of the two sources and the coincidence of the two impacts overall flood risk and varies with distance upstream from the ocean and other estuarine characteristics. While there are complex interactions between catchment and coastal flooding throughout the waterways, coastal conditions have a particularly strong impact on flooding in the lower reaches of the tidal waterways due to their influence on water levels. The joint occurrence of coastal and catchment flooding can have significant impacts on the MidCoast estuaries.

There is a long history of flooding on the MidCoast, with both cyclones and east coast lows having the potential to bring flood-generating weather to the region. It is known that a flood exceeding the 1% Annual Exceedance Probability (AEP) flood occurred in 1927 impacting the areas around Wallis Lake and the Myall Lakes.

Floods can pose substantial risks to ecosystems, built assets and human lives. Flooding by the estuaries can transport pollutants into the water bodies, impacting water quality and posing a risk to public safety, particularly for ICOLLS. Flooding can inundate property, infrastructure and environmental assets along the estuary foreshores.

Flood studies and floodplain risk management plans undertaken across the study area have shown specific areas where combined coastal and catchment inundation poses a risk. Section 2.4.4 describes these studies in detail.

Wallis Lake: There are significant areas with flood risk around Tuncurry and Forster, with present day PMF flood extents reaching from the foreshore areas into the CBDs. In the case of Tuncurry and Forster Keys, there is extensive low-hazard flooding of properties in the present day 1% AEP flood. Properties are also affected by flooding to various degrees in Coomba Park, Green Point and Pacific Palms. The projections for year 2060 and 2100 show increasingly worsening flood impacts throughout the area.

The Lower Myall River and Myall Lakes: The flood study shows that flood levels upstream of Monkey Jacket are strongly controlled by catchment flooding, where the majority of land is national park. Downstream of Monkey Jacket, ocean flood events are more significant, and in major events, there is flooding of properties adjacent to the Myall River in Tea Gardens and Hawks Nest.

Smith Lake: Flooding around the lake is largely governed by the management of the lake entrance. Flooding around Smiths Lakes has recently been avoided due to the opening policy in place to mechanically open the entrance when lake water levels reach 2.1 m AHD.

Flooding is expected to worsen in the future throughout the study area due to climate change and increased development. Emergency planning and response for these estuaries are provided in the various Floodplain Risk Management Plans.

Stressor 2.4 – Bushfires

Bushfires remain an ever-present risk across the vast expanse of naturally vegetated areas and adjacent urban fringe across the study area. Bushfires can affect waterways by removing vegetation thereby expose land to erosion. Erosion brings in excessive sediments in waterways, reducing water clarity and light penetration and bringing with it nutrients that can trigger algal blooms. Furthermore, the risk associated with bushfires is likely to become more severe over coming decades due to climate change (See Section 4.1.8). This issue is mostly managed though the Mid-North Coast Bush Fire Risk Management Plan, the NSW RFS and the NPWS. The CMP should seek linkages with these existing plans and managing authorities.

Stressor 2.5 – Drought

Drought impacts this area frequently, with the most recent 2019 drought being broken in early 2020. Droughts can heavily impact the quantity of freshwater inputs into the estuarine systems which has impacts on coastal wetlands and water quality and coastal ecosystems. It is likely that droughts will increase in frequency and magnitude in the future due to climate change.

Stressor 3.6 – Sea level rise

Sea level rise poses an ever-increasing risk to coastal communities. According to the latest IPCC report (IPCC, 2021), the global mean sea level (GMSL) is expected to increase by as much as 1 m by 2100 relative to the 1995-2014 average. This will expose vast areas of the coastal zone to erosion and more frequent or permanent inundation, displacing the communities that inhabit these coastal margins.

Currently there is minimal planning strategies outlined in the most recent EMPs and CZMPs across the LGA that address the issues associated with sea level rise. There is a high chance that the MidCoast estuaries will be impacted by sea level rise and management strategies are required to mitigate these impacts.

Stressor 4.1 - Urban stormwater discharge

The results of historical water quality monitoring indicates that the health of the estuaries with respect to water quality varies across the study estuaries. A summary of estuarine water quality is provided in Section 4.1.6. There are a range of pressures affecting estuarine water quality, and catchment runoff and urban stormwater discharge have been identified in previous studies as a key stressor – particularly in urban areas of the study estuaries. Urban runoff often contains a range of pollutants including sediment, nutrients, heavy metals, hydrocarbons, chemical compounds, and gross pollutants.

The achievement of good water quality within these estuaries is particularly important for the local community, as they are used extensively for a variety of recreational activities comprising primary and secondary contact activities.

Wallis Lake: There are two main areas of concern in Wallis Lake regarding poor water quality attributed to urban stormwater runoff from the Forster and Tuncurry townships. These include Pipers Creek and Wallamba Cove.

The majority of the Forster township is located in the Pipers Creek Catchment and therefore rainfall runoff drains directly into stormwater drains and Pipers Creek. Values recorded in this area in 2006/07 were five to six time greater than values expected for this ecosystem, with nutrient enrichment being the greatest problem in Pipers Creek (Great Lakes Council, 2009). Pipers Creek and Pipers Bay have experienced large algal blooms in the past and show signs of continued poor ecological health (MidCoast Council, 2021). It is currently in good ecological condition considering it receives significant runoff from a heavily urbanised catchment however there is still need for ongoing nutrient runoff control as there is still algal samples exceeding the guideline values (MidCoast Council, 2021). Following large rainfall events, waters from Pipers Creek and Pipers Bay can reach Wallis Lake and Charlotte Bay and therefore reducing stormwater runoff from the Pipers Bay Catchment has benefits for the whole of Wallis Lake (MidCoast Council, 2021).

Stressor 4.1 - Urban stormwater discharge

Wallamba Cove has remained in a moderate ecological condition since 2007 based on water quality testing (MidCoast Council, 2021). The area is directly impacted by stormwater runoff from Tuncurry, particularly in wet periods, with areas closest to input locations near the town centre experiencing the poorest water quality.

Smiths Lake: There are generally very little water quality issues in Smiths Lake however there are some small stormwater inputs from the Smiths Lake township that can carry pollutants with it (MidCoast Council, 2021). Despite only making up approximately 7% of the total land cover in the Smiths Lake catchment, runoff from urban areas account for about 30% and 42% of the total nitrogen and phosphorus respectively (Great Lakes Council, 2009). Due to these loads being relatively small compared to the lake size, there is minimal impact on the water quality however there is the risk of increase in water quality issues if these loads are not well managed.

Myall Lakes: The Myall Lakes has some minor sources of urban stormwater runoff including Bulahdelah in the Myall River catchment that can further contribute contamination into Bombah Broadwater if not properly managed, and Tea Gardens at the mouth of the Lower Myall River estuary. Discharge of stormwater at Tea Gardens can be transported upstream via tidal currents impacting on the water quality.

Stressor 4.4 – Agricultural runoff

The impact of agricultural runoff varies across the study estuaries depending on the extent of agricultural land use in the estuary catchments. Historical estuary and catchment studies and monitoring programs (Great Lakes Council, 2009; MidCoast Council, 2021; Great Lakes Council, 2015) have identified a number of water quality issues across the study area estuaries that are associated with runoff from agricultural land use within the catchment, including primarily nutrients and sediment from erosion. The waterways within the study area most at risk to these impacts are:

- *Wallis Lake:* The most dominant land-use type in the Wallis Lake catchment is agricultural pastures, more specifically unimproved pastures for beef production, which is particularly the case in the Wang Wauk and Wallamba River sub-catchments (Great Lakes Council, 2009). Based on previous (Great Lakes Council, 2009) and current (MidCoast Council, 2021) water quality assessments in the lake, the areas currently most at risk to the impacts associated with agricultural runoff include the upper and mid areas of the Wallamba and Coolongolook Estuaries. The upper estuaries have been heavily impacted by human activities resulting in elevated nutrient and sediment inputs that increase algal concentration and decrease water clarity resulting in moderate to poor ecological condition in these waters. Since the implementation of the WQIP (2009), the water quality of the Mid Wallamba Estuary has improved however water clarity and excess algal growth due to increased nutrients remain ongoing issues (MidCoast Council, 2021). This is also the case in the Coolongolook Estuary which highlights the need for ongoing improvements in nutrient management as these areas remain at high-risk to the impacts of agricultural runoff.
- *Myall Lakes:* There is a history of poor water quality in Bombah Broadwater linked to agricultural runoff from the catchment entering the lake via the upper Myall River and Crawford River catchments. The lake itself is surrounded by national park however most of its inflow originates in the upper Myall River and Crawford River catchments with much of the land directly adjacent to these rivers being agricultural land. This results in increased amounts of nutrients and sediment entering the river causing moderate to poor water quality. Due to the dynamics of Bombah Broadwater (see Section 4.6.3) these can accumulate causing toxic blue-green algal blooms such as that experienced in 1999. Blue-green algal blooms are still a concern with all samples in 2021 exceeding guidelines for algal concentrations by a moderate amount with blue-green algae scums present in the freshwater following March rains (MidCoast Council, 2021). Bombah Broadwater can also influence the adjacent waters of Myall Lake and the lower Myall River. During high rainfall, water from Broadwater can push upstream into the Myall Lake carrying nutrients and algae with it influencing the typically good water quality in this area (MidCoast Council, 2021). The Broadwater also heavily influences the water quality in the lower Myall River as the Broadwater is the direct source of flow so poor water quality in the Broadwater can flow downstream through the lower Myall River.

Stressor 5.6 – Introduction of invasive fauna and pest species /QX Oyster Disease

Invasive species have the potential to alter aquatic, coastal and terrestrial ecosystems, impacting both the ecosystems and the services they provide. They may cause environmental harm, economic harm, or impact human health. Invasive species can have a number of negative impacts on the areas that they invade. Perhaps the most significant of these is the widespread loss of habitat. Other invasive species may not destroy habitat but can have an impact by killing large numbers of endemic species. In addition to these impacts, invasive species can also have enormous economic costs.

Oyster farming has been the most valuable aquaculture industry in New South Wales for over 100 years. The NSW oyster aquaculture industry is the largest in Australia and is valued at $58.6 p.a million in 2018-2019 (DPI , 2021). Aquaculture, specifically oyster farming, is a regional specialisation in the MidCoast region. The biggest and recent threat to this industry particularly around the study area is the detection of the QX disease (*Marteilia syndeyi*) in its oysters. This has caused significant loss to the oyster industry within the study area - see Figure 8-4 and Figure 8-5.

The disease occurs seasonally and causes mortality in the native Sydney Rock oyster Saccostrea glomerata. QX is caused by a protozoan ('single-celled') parasite which is only known to infect invertebrate hosts and does not have any impacts on human health. The parasite enters the soft tissue of Sydney Rock Oyster through its gills and palps, and if it progresses damages the digestive gland of the oyster, resulting in starvation and eventual death of the oyster. Affected oysters can be in poor condition and appear translucent or “watery”. The digestive gland can also appear to be a light tan colour instead of the usual dark brown.

M. sydneyi requires at least two host to complete its life cycle, which means QX cannot be passed directly from one oyster to another (See Figure 8-5 and Figure 8-4). The identity of the alternate host(s) has not been confirmed, but there is evidence suggesting that a polychaete worm *(Nephtys australiensis)* could play a role in the development of the parasite. (Adlard and Nolan, 2015). QX stands for Queensland Unknown and was first identified in 1976 in southeast Queensland.

The disease was detected for the first time in Port Stephens estuary in August 2021, but has been recorded along the North Coast of NSW since around 1980. No record of this disease has ever been identified in the Wallis, Smith or Myall Lakes catchments.

Currently NSW DPI is continuing to investigate this outbreak at Port Stephens and monitoring it closely in 2022. To prevent its spread into low QX disease risk estuaries the Biosecurity (QX Port Stephens) Control Order 2021 has been issued. This order prohibits both oysters and cultivation equipment movements from all high-risk estuaries to low risk estuaries and is only permitted if it has been treated in accordance with the provisions of the specific QX Disease Biosecurity Order. This aquatic pest and disease have severely impacted the NSW oyster industry and continues to remain a big threat.

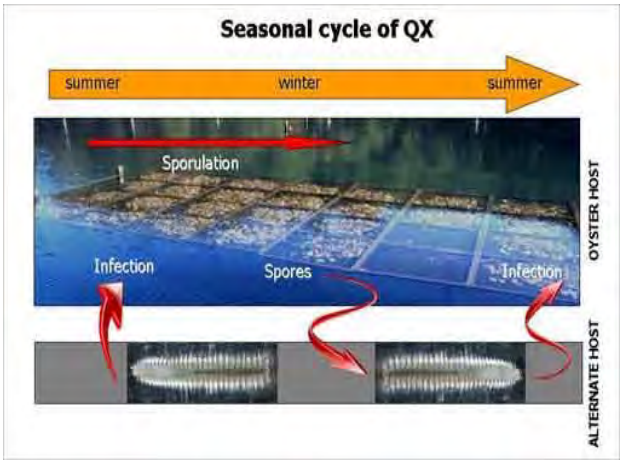

Figure 8-4 Seasonal Cycle of QX disease

Figure 8-5 Oysters with & without QX disease (source NSw.gov.au)

Stressor 5.7 – Damage, loss, or disturbance of indigenous heritage (tangible or intangible)

The Great Lakes Region has a rich and continuing Indigenous heritage, with cultural history extending several thousand years – see Section 4.6.1. Previous estuary processes studies and CZMPs have undertaken searches for registered sites and found a significant number of heritage items and areas of significance across the study area catchments. These areas and items, such as middens, are found in the coastal zone and are therefore at risk of erosion.

Future development across the catchment has also been identified as a significant threat to indigenous cultural heritage. This should be considered in relation to the planned development across the study area over coming decades, which will include significant amounts of excavation and disruption of foreshore land.

Stressor 6.4 - Estuary Delta Migration

The study area's flood-tide deltas occur the landward side of tidal inlets and are modified by incoming tidal currents and waves. They are dynamic features and create shoals that grow as sediment erodes from the estuarine beaches and accumulates at the landward end of inlets (Vila-Concejo, Short, Hughes, & Ranasinghe, 2007).

Port Stephens has an extensive shallow flood tide delta that extends across the estuary entrance and is continuously modified by the complex interaction of tides, waves and minor flows from the Lower Myall River along the northern shore (BMT WBM, 2011). Generally, sediment erodes from the estuarine beaches and is trapped and deposited in the flood-tide delta, which occupies most of the outer estuary. The delta dynamics are related to the dynamics of the Myall River mouth and Winda Woppa spit. There has been a noted net loss of sand in the flood-tide delta from 1851 and it has been speculated that this erosion and subsequent deepening of the estuary allowed the breaching of the Winda Woppa spit by a storm in 1927 (Thom, et al., 1992). However, Vila-Concejo et al. (2007) found that the flood-tide delta has increased in its extent since 1963.

Although smaller in scale, Wallis Lake also has a migrating flood-tide delta that results in changing estuarine depths by its entrance. Smiths Lake similarly has a dynamic flood-tide delta when open to the ocean.

It is clear that flood-tide deltas are very dynamic features that have a major influence on the morphology and depth of estuaries. The moving shoals can pose significant risks to waterway navigation, and impact on the estuarine environment, such as benthic ecosystems. The oyster industry has also identified shoaling in the estuary as a risk to operations. Better understanding of how flood-tide deltas migrate and the involved sediment dynamics is important to improve future management of the estuary and its beaches.

Stressor 6.6/7 – Unsustainable recreational and commercial fishing practices

Currently, commercial fishing is permitted at Port Stephens, Smiths Lake and Wallis Lake and is a significant industry in these areas that supports livelihoods and the local economy. Wallis Lake supports the fifth largest number of fishing businesses of any NSW estuary and the second largest overall catch (in kg) (Fiebig, 2010). The commercial fishing industry in one of the largest industries in the Wallis Lake region, estimated to be valued at approximately $22 million per annum (Fiebig, 2010).

Efforts in Wallis Lake to improve water quality and maintain compliance to the Fishery Management Strategy for the Estuary General Fishery outlined in the previous ECMP has aided in providing a sustainable commercial and recreational fishing industry. However, given the increasing population and increased interest in fresh seafood it is important these sustainable practices are maintained or improved to ensure that meeting any increase in demand is not prioritised over a healthy and sustainable fishery for all to enjoy.

Stressor 8.1 – Overcrowding / congestion of waterways and user group conflict

The townships of the MidCoast LGA are popular tourist and homeowner destinations. According to Destination NSW (2021), between June 2012 and June 2019 (excluding 2020 and 2021 due to impact of COVID-19 on tourism) the amount of overnight and daytrip visitors to the Mid-North Coast Region of NSW (which includes MidCoast Council) increased by 22% from 10,402 in 2012 to 13,317 in 2019. This rate of increase in tourism is expected to continue or increase further into the future causing issues of congestion and overcrowding of waterways due to the increased number of vessels these visitors bring with them. Additionally, there is expected to be an increase in permenant population in these areas that will further increase the stress on these waterways. According to Transport for NSW (2022), there are approximately 5600 registered vessels in the townships adjacent to the study lakes, which equates to approximately 20%

of the population in those areas owning a registered vessel. These areas, including Forster and Hawks Nest, are expected to have the greatest population growth in the area (Table 4-13) and thus it is likely there will also be a 20% increase in the number of vessels registered in the area.

However, these estimates of vessels do not take into account unregistered and unpowered recreational vessels, including kayaks, paddleboards, small sailing boats etc, which account for a significant portion of the waterway use.

The summer months, particularly the Christmas/New Year holidays, are expected to be the times when overcrowding and congestion of water ways are experienced the most

This is likely to put more pressure on the estuaries with regard to overcrowding, particularly in the holiday period in summer when the increase in population and number of vessels is compounded by more tourists.

Stressor 9.1 – Water pollution/ contamination affecting human health and safety

Maintaining good water quality of estuarine and coastal waters is essential to human health, the environment, agriculturally based industries and the recreational value of waterways, wetlands and coastal waters.

Water pollution/contamination can arise from several sources, including urban stormwater discharge, agricultural runoff, and sewage effluent and septic runoff across the catchment. These pollutants can affect human health and safety for those coming into contact with water through primary and secondary recreation, particularly following periods of heavy rainfall.

Past studies have recorded a number of water quality issues across Wallis Lake, Smiths Lake, Myall Lakes and Karuah River. These issues were addressed in the WQIP (2009) (discussed in Section 4.1.6) and have been the subject of the yearly Report Card Monitoring Program (Section 6.3). Generally speaking, water quality has improved across the estuaries since the WQIP was implemented in 2009, with Smiths Lake, the northern areas of Myall Lake and the southern areas of Wallis Lake being regarded as some of the highest water quality waterbodies in the area.

There continue to be water quality issues in Pipers Creek and Mid Wallamba River in Wallis Lake due to urban stormwater runoff, Bombah Broadwater in the Myall system due to agricultural runoff and Upper Karuah River due to sewage and effluent runoff from further up the catchment. Sewage overflows in Smiths Lake and North Arm Cove have historically resulted in water quality issues also. These issues can impact on human safety when interacting with these waterways, particularly after large rainfall events.

Stressor 9.3 – Safe, navigable waterways – Entrance Bar

Wallis Lake is an important location for both recreational and commercial vessels. It provides safe mooring for vessels traveling up and down the NSW coast, particularly when marine conditions are poor.

Despite the presence of training walls, the Wallis Lake entrance is strongly influenced by ocean conditions and navigation can be dangerous under certain conditions. This is partly due to dynamic and shallow entrance bars.

According to the Taree – Great Lakes Regional Boating Plan (Transport for NSW, 2015), incidents in the bar are uncommon, only accounting for 1 of the 22 marine incidents that occurred between 2009 and 2013, however they can have severe consequences.

Stressor 10.1 – Lack of adequate coordination between management agencies

As discussed in Section 6.4, stakeholder engagement undertaken during this study has identified that a major barrier to effective coastal management is the lack of coordination and collaboration across relevant governance bodies at both a local and state level. Additional detail is provided in Section 6.4.

Stressor 10.2 - Lack of compliance with regulations (by users) or lack of regulation effort (by agencies)

The stakeholder and community engagement component of the Scoping Study identified that a there is a lack of compliance with regulations across the study area, particularly in relation to:

- Illegal dumping and pollution of the waterways and foreshores;
- Adherence to development controls across estuary foreshores and (particularly in regards to on-site water management and sediment controls);

- Illegal clearing of foreshore areas (vegetation vandalism) and mowing areas of foreshore thus destroying habitat;
- Driving on the lakebed of Smiths Lake;
- Anti-social behaviour on the waterways from recreational boating; and
- Agricultural practices and water extraction across the upper catchment of the estuaries.

Many stakeholders identified that a lack of funding and coordination across relevant agencies is preventing adequate compliance effort.

Stressor 10.3 - Lack of funding for investigation and action implementation

For both Local and State government agencies, a lack of funding was consistently identified as a barrier to effective estuary and catchment management (see Section 6.4). A lack of funding across Local and State Government inhibits the ability to:

- Collect data and commission technical studies to identify key issues and threats and assess management solutions.
- Implement effective management actions, including capital and maintenance works; and
- Undertake effective monitoring and regulation of compliance effort across the estuary system(s) and catchment.

Stressor 11.4 – Incomplete ecological information (including climate change impacts)

The entire study area has exceptional biodiversity which are of both regional, state and national importance. The literature on flora and fauna indicates biodiversity that is unique and exclusive to this region. There is wealth of excellent ecological information for example Glasby and van den Broek in 2010, identified that there are several sponges, ascidians and moslluscan fauna (some that are undescribed to science and need further research, investigation and monitoring) but there is a lack of research and ecological information of waterbirds, amphibian, mammals and other species.

Coastal wetlands, saltmarshes and littoral forest around estuaries are highly vulnerable to climate change impacts particularly sea level rise. Predicted changes that could occur under climate change conditions need further investigations. The ecological mapping of seagrass meadows and other coastal vegetation needs updating. Stressors such as increased nutrients, sedimentation, poor water quality, sand mining, dune stripping degrading etc can dramatically reduce and or change the biodiversity The loss of habitat within the catchment can result in loss of species diversity of plants, animals, invertebrates and degradation of natural environment loss of biodiversity.

Climate change is predicted to be the greatest long-term threat to biodiversity in the world. The extremes of weather patterns could see a loss of species, species forced to migrate to new areas, completed loss of non-mobile species (seagrass, trees) that cannot adapt and could have a knock-on effect upsetting the delicate balance and in worst case could see food webs and ecosystems collapse completely. There is very little understanding of the impacts of climate change on the ecology of the study area,

The current information does not provide a holistic reflection on the biodiversity of this region and reveals several knowledge gaps in terms of ecological information in general. There is also a lack of information on invasive species and information targeted at managing threatened species. The lack of ecological information means a barrier in managing the coastal areas moving forward.

An additional 11 threats were identified and deemed likely to become high risk over future planning horizons as a result of climate change, population pressures and future development. These are summarised in Table 8-7, and should be assessed in further detail during the Stage 2 Risk Assessment.

Table 8-7 Future / Emerging High-Risk Stressors and Key Issues

Future and Emerging Stressors (and associated ID from Table 7-3)
▪ 3.1 Ocean/estuary temperature increase and acidification ▪ 3.2 Altered storm frequency & severity ▪ 3.3 Altered hydrological regimes ▪ 3.7 Habitat migration and squeeze ▪ 6.1 Increasing groundwater extraction / use ▪ 8.4 Limited or lack of disability access ▪ 11.1 Incomplete coastal process information (including climate change impacts) ▪ 11.2 Incomplete ecological information (including climate change impacts)

9 KNOWLEDGE GAPS

A review of existing information and a knowledge gap analysis was undertaken to identify focus areas for CMP actions, and to assist with planning additional studies to be undertaken in Stages 2 and 3. The *NSW Coastal Management Manual Part B: Stage 2 – Determine risks, vulnerabilities and opportunities* sets out the requirements for the nature and rigour of the information required in Stage 2 to provide information to support decision-making in later stages of the planning process. In that document, information requirements are provided for each of the four (4) coastal management areas. These requirements have been used to determine the adequacy of existing information and subsequently potential knowledge gaps to be filled. This gap analysis is generally informed by a risk-based approach, as outlined in Figure 9-1.

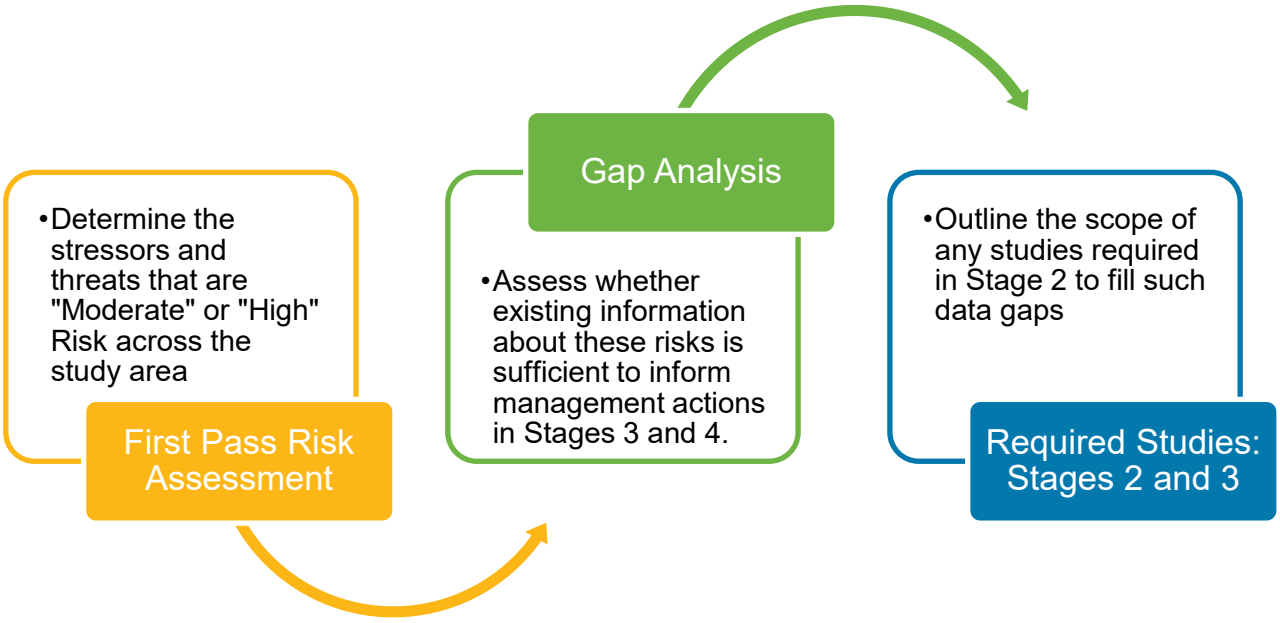

Figure 9-1 The FPRA and Gap Analysis Process

9.1 Adequacy of Existing Information and Knowledge Gaps

The adequacy of existing information and datasets has been systematically reviewed. There have been a number of studies over the past 20 years that cover a range of spatial scales and localities. The types of datasets collated as part of this task are summarised in Figure 9-2 below.

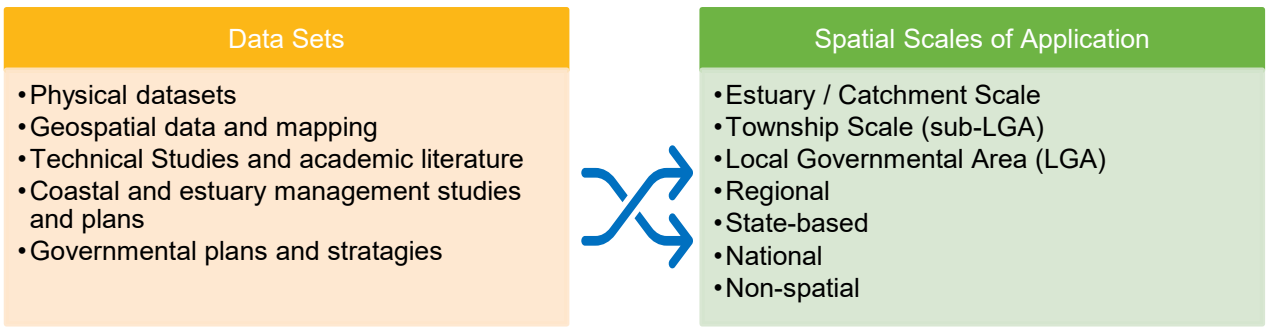

Figure 9-2 The Nature and Scope of Relevant Datasets

As part of this literature review, relevant informational studies, current and past management plans, and additional datasets were identified and reviewed in terms of their relevance and application to the CMP. A summary of this data is presented in Appendix B. The major bodies of work relating to *risk, vulnerabilities and opportunities* across the study area comprise a range of datasets, including:

- Coastal and Estuary management plans (and supporting technical studies) described in Section 6.1, and relevant flood risk management plans;
- Local Coastal and Estuary Hazard Studies. These are described in Section 9.1 in relation to their application to the CMP process;
- Datasets available through monitoring programs across the study area (See Section 6.3);
- State based technical studies and management plans, including (but not limited to):
  - The MEMS Threat and Risk Assessment (BMT WBM, 2017);
  - The NSW Tidal Inundation Exposure Assessment (DPIE, 2019);
  - The NSW Estuary Health Risk Dataset (DPIE, 2019a);
- Other technical studies undertaken such as The Great Lakes Water Quality Improvement Plan.

As part of the Scoping Study, it was necessary to assess the adequacy of existing information pertaining to each of the stressors assessed as part of the first-pass risk assessment (discussed in Section 8.30). Subsequently, a gap analysis framework approach was applied to this study. Given the multi-estuary nature of the CMP study area, and the fact that previous studies have generally been carried out at an estuary scale, an assessment was conducted for each of the four study areas/estuaries.

For each stressor, the adequacy of existing knowledge relating to that stressor was assessed, based on the age of the data and the spatial coverage across each waterway area. For this task, a designation for whether the available data was adequate to inform Stage 3 management decisions was based on the criteria presented in Table 9-1. This assessment of the adequacy was based on the technical expertise of the project team, and consultation with key stakeholders (such as relevant state government agencies).

Table 9-1 Assessing the Adequacy of Existing Information

Knowledge Adequacy	Description
High	Existing data regarding the stressor / issue is sufficient and further work does not need to be undertaken during Stage 2 of the CMP.
Moderate	Information regarding the stressor is incomplete and/or may be becoming outdated. Additional studies may be needed in Stage 2 to fill the knowledge gap and improve the effectiveness of management. This is assessed on a stressor-by-stressor basis and depends on the spatial coverage and veracity of the data, and the overall level of risk presented by the stressor.
Low	There are significant technical or geographical data gaps, and management actions cannot proceed effectively without this knowledge. Subsequently, studies need to be undertaken during Stage 2 of the CMP to fill the knowledge gap.

The need for additional studies has been assessed based on the outcomes of the FPRA, the review of the adequacy of existing information and the stakeholder engagement workshop. For each of the threats listed in Section 8.3, the need for additional studies has been identified based on the following criteria for each stressor:

- *Additional information is required* when the adequacy of existing information is defined as **Low**; **AND** the overall risk associated with the stressor is given as **High**.

- *Additional information may be required* when the adequacy of existing information is defined as **Low**; **AND** the overall risk associated with the stressor is given as **Moderate**. In this case, the need for additional studies has been based on the applicability of existing data - in terms of spatial coverage, age and technical veracity.

The results of the gap analysis are presented in Appendix E in full. A summary is provided below, broken down by the Threat categories identified in Sections 8.3 and 8.4.

Resultant studies required during Stage 2 of the CMP are provided in Section 9.2.

9.1.1 Coastal Hazards

Coastal hazards have been assessed and mapped across the four estuaries through a number of estuary process studies, hazard studies and flooding/inundation studies, as described in Section 2.4.4. Table 9-2 shows the applicability of these existing studies with regards to the seven coastal hazards listed in the CM Act, and the adequacy of information to inform risk and mitigation options during Stage 3 of the CMP.

Table 9-2 Applicability of Existing Hazard Information to the Study Area

Hazard Type	Wallis Lake	Smiths Lake	Myall Lakes	Northern Foreshores of Port Stephens	Khappinghat and Blackhead
Tidal inundation (sunny day flooding)	No specific detailed site studies have been undertaken to date. However, these estuaries have been assessed as part of the broad-scale *NSW Estuary Tidal Inundation Exposure Assessment* (OEH, 2018g). The overall exposure of the study area to tidal inundation is discussed in Section 2.4.4, and the report / associated mapping shows that there is a large amount of land, and a significant number of properties likely to be affected by tidal inundation across the study area up to +1 m SLR (over 1,500). Therefore, the risk associated with tidal inundation is expected to be very high over longer time frames (as discussed in the FPRA in Section 8). Whilst the broad-scale *NSW Estuary Tidal Inundation Exposure Assessment* (OEH, 2018g) provides an informative high level overview, it should be noted that the report states that caution should be used to assess risk to individual properties and assets, and that the study does not replace the need to undertake more detailed flood or inundation studies where high levels of risk are evident. Based on this, the following is noted: ▪ The methodology of the study (which maps the HHWSS tidal plane) is considered to be fit for purpose for the downstream area of estuaries where those tidal planes are considered to be representative. However, the DPE mapping is not considered particularly robust in its ability to consider and account for complex hydrodynamic processes that affect tidal inundation in the mid to upper estuary – including the influence of tidal asymmetry, tidal pumping and/or tidal amplification. ▪ Furthermore, the DPE tidal inundation mapping assessment does not consider the impacts of the local stormwater network on tidal inundation processes – which is likely to be a significant factor in the Foster / Tuncurry township. ▪ Whilst mapping exists, at present this information has not been cross referenced with a Councils asset & infrastructure database in order to determine what public assets will become exposed to risk, and over what timeframes. Therefore, a detailed, site-specific assessment is required in order to more robustly and accurately quantify the risk associated with tidal inundation.				Given the low level of exposure, the data provided in the *NSW Estuary Tidal Inundation Exposure Assessment* (OEH, 2018g) is sufficient for assessing risks associated with tidal inundation for these estuaries, and additional studies are not warranted.
Coastal inundation, and combined coastal / catchment inundation	Information regarding combined coastal and catchment flooding is assessed and mapped as part of the Wallis Lake Floodplain Risk Management Study – Flood Study Review (WMAWater, 2014). It includes a range of catchment and coastal flooding scenarios and incorporates climate change projections and future sea level scenarios of +0.5m, and +0.9m. The study is robust, and contemporary, and considered sufficient to make informed management decisions during the CMP.	Information regarding coastal and catchment flooding is addressed in the Smiths Lake Flood Study (Webb, McKeown & Associates, 2008). Whilst no SLR scenarios were considered as part of the study, any future updates to incorporate SLR should be undertaken under the NSW Flood Risk Management Framework. This data is considered sufficient to make informed management decisions during the CMP.	Information regarding coastal and catchment flooding was assessed and mapped as part of the Lower Myall River and Myall Lakes Flood study (BMT WBM, 2015). It also incorporates climate change projections and future sea level scenarios of +0.5m, and +0.9m. The study is robust, and contemporary, and considered sufficient to make informed management decisions during the CMP.	Information regarding coastal and catchment flooding is assessed and mapped as part of the Karuah River and Stroud Flood Study Update (Advisian, 2021), and the Port Stephens Design Flood Levels – Climate Change Review (WMAwater, 2010). It also incorporates climate change projections and future sea level scenarios of +0.5m, and +0.9m. This data is considered sufficient to make informed management decisions during the CMP.	Information regarding coastal inundation for the region is provided in the Great Lakes Coastal Hazard Study, and Greater Taree CZMP. This data is considered sufficient to make informed management decisions during the CMP.
Estuary entrance instability	N/A	Estuary entrance instability and erosion of coastal entrances is incorporated within the beach erosion and shoreline recession hazards mapped in the Great Lakes Coastal Hazard Study (SMEC, 2013). Should this information require updating in the future, it would be more appropriately undertaken as part of the Open Coast CMP.	N/A	N/A	Entrance management for Khappinghat Creek is managed by NPWS under the relevant Plan of Management. Entrance management for Blackhead Lagoon has been assessed as part of the relevant Entrance Management Plan (2006).
Beach erosion and long term shoreline recession	N/A	N/A	N/A	An assessment of erosion hazard was undertaken as part of the Lower Pindimar, Pindimar, Upper Pindimar and Bundabah Foreshore Erosion Study (BMT WBM , 2010). The study is robust and provides a detailed account of erosion in this location. This data is therefore considered sufficient to make informed management decisions during the CMP.	N/A
Open coast cliff/slope instability	N/A	N/A	N/A	N/A	N/A

9.1.2 Land Use Intensification & Environmental Impacts

Water quality datasets from the "The Waterways and Catchment Report Card Program", is a catchment based estuarine and freshwater monitoring and reporting program currently implemented by a partnership between MidCoast Council and the NSW Department of Planning and Environment. Program provides a strong baseline of water quality data that can be used to assess water quality across the study area estuaries and the impacts of catchment land use, urban stormwater runoff and agricultural runoff. The water quality parameters available in this dataset are outlined in Section 6.3.

It is anticipated that this body of information should be sufficient to inform Stage 3 management decisions. Therefore, no additional water quality data collection is proposed for Stage 2.

Another high-risk stressor in this category is damage, loss or disturbance of indigenous heritage (tangible or intangible). It is anticipated that data available from the NSW State Government's Aboriginal Heritage Information Management System (AHIMS) sites register, and engagement with local indigenous groups, should be sufficient for assessing risk and developing corresponding management actions. If the Stage 2 risk assessment shows that there are critical knowledge gaps regarding indigenous heritage across the study, then any additional studies, whilst important, could reasonably be incorporated as a management action in Stage 4 of the CMP.

9.2 Studies to be Prepared in Stage 2

The recommendations for further detailed studies and associated tasks are described in Table 9-3, which indicates that three studies will be required in Stage 2, in order to inform the development and assessment of management actions in Stages 3 and 4.

Table 9-3 Studies to be Prepared During Stage 2 of the CMP

MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment
A tidal inundation study is required in order to identify those areas exposed to tidal inundation (sunny day flooding), and to assess the associated social, environmental and economic risks. The study should cover the estuaries of the Wallis Lakes system, Smiths Lake, Myall Lakes System, and the Port Stephens Estuary up to (as a minimum) their tidal limits. As part of this study, detailed 2D hydrodynamic modelling should be undertaken in order to assess the frequency and magnitude of the tidal inundation over the study area – including mapping present day and future tidal planes. The study should be undertaken for a range of planning periods, in order to assess the impacts of future sea level rise, including Present Day (2022), 20 years (2042), 50 years (2072), 100 years (2122). The study should utilise the latest SLR projections from the IPCC 6th Assessment Report (2021). The study should include the following components: ***Inundation Hazard Analysis and Mapping*** ▪ Literature Review and Data Collection: To collate all relevant information necessary for the completion of this tidal inundation study, including bathymetric and topographic survey, tide gauge data, and information relating to the components that comprise storm ides (winds, waves and barometric pressure). ▪ Hydrodynamic model set-up, calibration and validation: The study should utilise a hydrodynamic modelling software and configuration that can replicate all of the relevant physical processes and is suitable to achieve the required objectives of the study. The model set-up should include, where relevant, the influence of engineering (including flood mitigation protection) structures and hydraulic linkages through stormwater systems and natural drainage paths. If existing models for the study area exist, then they can be utilised for the purposes of time and cost efficiency.

- Modelling of tidal inundation scenarios: Detailed, two-dimensional (2D) modelling of storm tide inundation and tidal inundation across the estuaries, for the scenarios outlined above.
  - For tidal inundation scenarios, this should also include identification of potential changes to tidal regime (including tidal planes) and tidal hydrodynamics within the estuaries.
  - Consideration of potential impacts regarding habitat 'squeeze' and upslope migration of macrophytes across the estuarine coastal zone due to rising sea levels and altered salinity profiles and opportunities for habitat expansion.
  - Consideration of permanent groundwater impacts, including those associated with ecosystem functioning, built asset and infrastructure risks and contamination impacts.
- Mapping: Output from the study should include detailed inundation mapping of a sufficient resolution to inform a property level risk assessment across developed area of the foreshore. However, it is noted that this resolution will not be required the undeveloped foreshore reserve and national parks frontage of the estuaries.

Risk Assessment

The purpose of the risk assessment will be to utilise the inundation mapping to provide a quantitative assessment of the risks to public assets and private land within the study area.

- *Identification of at-risk assets:* The risk assessment will identify and catalogue those assets at risk in the present day, as well as those will be become exposed to tidal inundation risk over future planning horizons of 20, 50, and 100 Years - in accordance with the process described in the NSW Coastal Management Manual 2018.

  The risks to public assets should be based on Council's GIS database of wastewater, water supply, roads, buildings and other Council owned infrastructure. This geospatial information should be superimposed onto the inundation mapping GIS layers and aerial photography – in order to identify at risk assets.
- *Identification of at-risk ecosystems:* The assessment should also consider potential risk to coastal wetland habitats resulting from upslope migration and habitat squeeze.
- *Risk Assessment*: The levels of risk to identified land and assets should be assessed through an established risk-management framework, such as that set out in ISO 31000 (2009). The risk assessment process should consider the likelihood, frequency and consequence of inundation impacts to such infrastructure. The information from the detailed risk assessment will help identify priority issues for response and appropriate risk treatment management options in Stage 3.

Summary Report

- The details of the analysis and risk assessment should be summarised in a Technical Summary Report.

It should be noted that a significant portion the Myall Lakes estuary and its catchment are located within the land tenure of the NSW National Parks and Wildlife Service (NPWS). Therefore, if deemed beneficial during the project scoping stage, this study may involve coordination and collaboration with NPWS.

Coastal Wetland Mapping and Condition Assessment, for Wallis and Smiths Lakes Estuaries

During the stakeholder workshop, it was indicated by numerous stakeholders that the CM SEPP mapping of Coastal Wetlands in the Wallis and Smiths Lake estuaries was not considered accurate enough to appropriately inform development controls, or to use as a basis for decision making in Stage 3 of the CMP. Preliminary analysis of vegetation mapping provided by MCC, and inspection of aerial imagery during this scoping study have also confirmed that a formal technical review and accuracy of the mapping is warranted.

Coastal Forested Wetlands, Freshwater Wetlands and Estuarine Wetlands are amongst the most sensitive and significant vegetation formations in the MidCoast Council (MCC) coastal zone. They occupy transitional ecotones that could be susceptible to sea level rise, erosion, inundation, salinity change and also to developmental and land use changes in their surroundings. All such activities can impact on these habitats and in some cases restrict the ability for wetlands to naturally migrate. This study would provide a better

understanding of distribution and condition of wetland systems. It is needed to inform the development of strategies to mitigate future negative impacts on wetlands and their values.

The mapping, description, and condition of wetland communities with the MidCoast LGA has also been completed at Manning River (Part of CMP stage 2 study) and Karuah & Myall River catchments. Such data is absent for other estuaries in the study area, i.e. Wallis and Smith Lakes. Thus, a study in Stage 2 is recommended to address this data gap.

The method used should be consistent with that used for the Manning River and other catchments and will include the following:

- Collation and synthesis of available data and existing maps of wetlands in the study area catchments
- Aerial photo interpretation to delineate spatial field surveys, and to define and map separate wetland types, identify threats and assess their condition
- Prioritisation of wetland areas for conservation and management
- Development of a set of recommendations for restoration and protection

The methods proposed has the following advantages:

- Offers consistency of data and methodology across the LGA equipping managers for better management and development policies.
- The method used is fine scale compared to the one use by DPI Fisheries and considered all wetlands including estuarine and freshwater wetlands.

The overall coast of this study would be $50,000-$60,000. The output of such study will provide information for multiple purposes, including increasing understanding of coastal wetland systems, improving the accuracy of State Environmental Planning Policy (SEPP) mapping, using fine scale data for assessing climate change risk and using the information to guide actions in the CMP.

Risk Based Framework Assessment for Blackhead Lagoon and Khappinghat Creek

The First Pass Risk Assessment and Gaps Analysis has identified that a hybrid Stage 2/3 study is required to develop performance criteria for protecting and improving the water quality and flow related objectives for the Khappinghat Creek and Black Head Lagoon estuaries – and in doing so, inform development controls for those catchments.

To accomplish this, the approach outlined in the Risk- based Framework for Considering Waterway Health Outcomes in Strategic Land use Planning Decision (RBF) will be applied. This scientific approach is used as a tool to help manage the impact of land-use activities within these catchments. This Framework brings together existing principles and guidelines recommended in the National water Quality Management Strategy.

The Risk based Framework is a five-step process that decision-makers can use to manage the health of waterways in New South Wales. It brings together existing NSW Government policy and is a key tool being used to improve the management of diffuse source water pollution under the Marine Estate Management Strategy 2018-2028.

Figure 9-3 provides a detail explanation of the 5-step process. The Study would focus on Steps 1 to 4 of the RBF for these two estuaries – and therefore would align with the CMP Stages as a hybrid Stage 2/3 study.

Framework flowchart

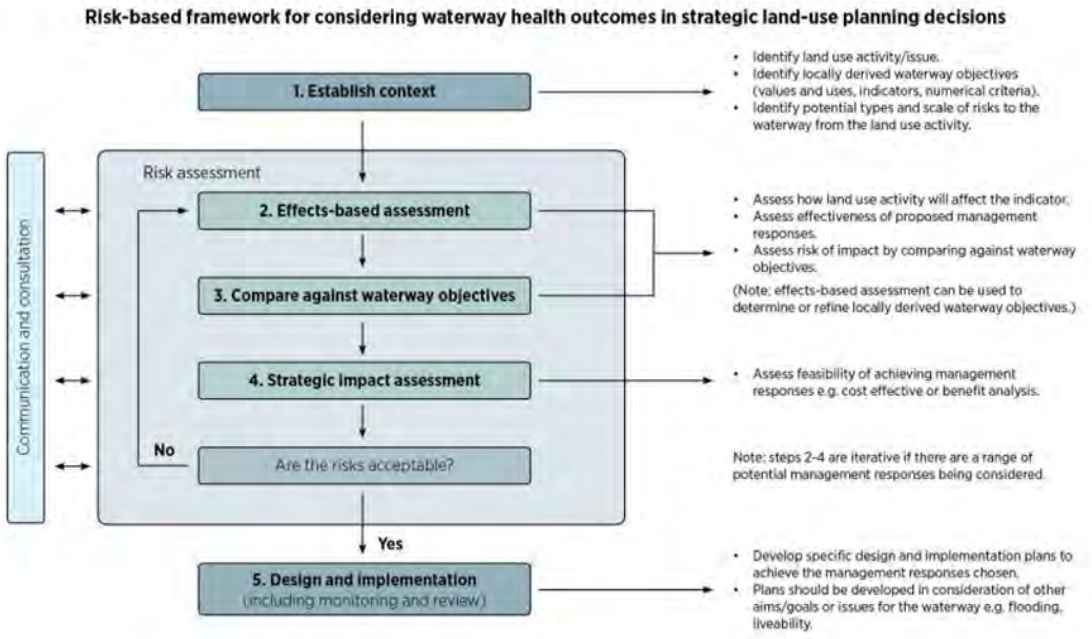

Figure 9-3 The Risk Based Framework (OEH, 2017)

Based on the current land uses practices and water quality ratings in the two estuaries - the methods for developing performance criteria for achieving water quality and flow related objectives in Khappinghat Creek catchment will differ that of Black Head Lagoon.

In Khappinghat estuary, the performance criteria will likely consider instream water quality and flow-based objectives, along with riparian health and erosion controls. The aim would be to determine the water quality load reductions targets and volumetric flow targets to maintain estuary health.

Whilst the same Framework is applied in Black Head Lagoon, the performance criteria for improving the quality and quantity flow targets will involve the following steps. To translate the waterway objectives, a calibrated MUSIC (Model for Urban Stormwater Improvement Conceptualization) model will be developed to establish a baseline condition for the estuary. MUSIC has been widely adopted industry standard model for assessing compliance with stormwater management targets. The MUSIC model will develop the operational phase stormwater quality and quantity (flow) targets for Black Head Lagoon. Alternatively, a box model approach may be applied if more efficient. The analysis should test for multiple future development scenarios to determine the optimal development controls.

<u>Advantages:</u>

This study will determine the water quality load reductions targets and volumetric flow targets to be incorporated into their development controls. This will not be a one-size-fits-all approach, the targets would be specific to each estuary.

The overall cost of this study for Khappinghat & Black Head estuaries approximately range between $35,000 -50,000, and would be subject to the amount of modelling work required once the project has been scoped further.

10 PRELIMINARY BUSINESS CASE

This section outlines the Business Case for the development of Stages 2 through to 4 of the CMP processes. It should be noted that the scope of Stage 5 will only be known when the full suite of coastal management actions is developed during the preceding stages, and as such Stage 5 has been excluded from the Business Case. Stage 4 of the CMP process includes the development of a Business Case for the actions proposed in the CMP.

10.1 The Benefits of Undertaking a CMP

The MidCoast Southern estuaries are important environmental, social and economic assets for MidCoast Council. These estuaries possess pivotal environmental values and are major contributors to the social and cultural wellbeing of the community. They are also an economic resource and contribute to the local economy in many important ways, some of which include:

- *The economic value of the ecosystem services provided by the Lake systems and estuaries is approximately **$1.16b p.a.** (high level estimate only)*
- *The social and environmental values of the estuaries contribute to local tourist visitation. The study area includes, Wallingat National Park, Myall Lakes National Park, Worimi Conservation Lands, Booti, Booti National Park, Karuah National Parks, Wallis Island, Coomba Park and the lakes systems - and these assets comprise a major tourist drawcard for the region. The economic value of tourism and domestic day trips across the LGA is estimated at **$192 m p.a**.*
- *The value of associated industries that utilise the estuaries is over **$265m p.a.** (across the LGA)*

The estimated costs of preparation of the CMP, through various elements in each stage, are outlined in Section 11.2. It can be observed from this business case that the cost of development of the CMP is less than 0.1% of the annual economic value of the estuaries – in terms of the value of economic activity in the area that is dependent on the estuary, and the economic and ecosystem service value of a healthy estuary system. Therefore, development of the CMP is a sound investment in the local and regional economy.

There are a range of threats and stressors that currently present a risk to the environmental, social and economic values of the study area – and the southern estuaries will come under increasing pressure from urbanisation, population growth, agricultural land use, and climate change over coming decades. Development of a CMP in line with the NSW Government Coastal Management Framework is the most effective way to identify and manage such threats and achieve the objectives set out in the Coastal Management Act. A CMP will set the long-term strategy for the coordinated management of the estuaries – and ensure that the values and benefits are enhanced and maintained for future generations.

It is anticipated that the **benefits** of a CMP will include:

- The CMP will provide an opportunity to develop a strategic and integrated long-term program. The “systems” approach of a CMP means that Council can more effectively address catchment-based issues, threats and risks, and approach estuary issues in a broader strategic context. The risk-management process outlined in a CMP promotes the identification of current and future risks across a range of planning horizons – allowing Council to adequately prepare for emerging threats;
- Improved coordination and collaboration across the governmental stakeholders responsible for managing the coastal zone. This includes strengthening relationships, and developing a shared understanding of the values, risks and management priorities for each of those stakeholders;
- The CMP process provides significant pathways for community engagement and can establish strong working relationships with community networks and stakeholders which are built on mutual trust and respect (OEH, 2018a). This includes providing avenues for collaboration with relevant indigenous stakeholder organisations i.e., Traditional Owners and LALCs;

- The CMP will provide a robust and defensible platform to secure funding for coastal management actions from the NSW Government's Coastal and Estuary Grants Program. The preparation of a CMP will enable the funding and implementation of a number of projects that will provide tangible benefits to the local community by improving and maintaining safe and sustainable access to the estuary, and protecting public assets in areas subjected to current and future coastal hazards; and
- The Adoption of a CMP also provides Council with exemption of liability. As detailed under Section 733 of the NSW *Local Government Act 1993*, through adoption of a CMP, Council '*does not incur any liability in respect of any advice furnished in good faith by the council relating to the likelihood of any land in the coastal zone being affected by a coastline hazard (as described in the coastal management manual) or the nature or extent of any such hazard'*.

Additionally, there are a number of *risks* associated with not developing a CMP. These include:

- A lack of understanding of key threats to estuary values and areas exposed to coastal hazards can result in inadequate or ineffective management practices and development controls;
- The lack of a system wide approach promoted by the CMP process can result in an inability to properly address wider, catchment scale issues and threats;
- The lack of an adequate risk management process can result in a diminished ability to effectively evaluate and prioritise management actions - reducing the cost-effectiveness of government efforts and resources;
- A lack of engagement with the local community can result in a lack of support or even opposition amongst the community and key user groups. This can result in a deficit of credibility and trust between Council and the community, and can derail the implementation of future management actions;
- A lack of engagement with the local community around key values and issues can result in an incomplete understanding of local community values – and therefore a misdirection of management effort and resources.

10.2 Funding Mechanisms and Cost Sharing

The costs associated with delivery of the CMP can be partly funded by the NSW Coastal and Estuary Grants Program, administered by DPE. The program supports coastal and estuary planning projects and the implementation of works identified in certified CZMPs or CMPs. Funding is available under 5 funding streams: a planning stream and four (4) implementation streams. Development of the CMP could be partly funded through the planning stream, which provides funding for planning projects that aim to:

- Develop a CMP;
- Transition an existing CZMP into a CMP; and,
- Undertake investigations and designs or cost benefit analyses for infrastructure works recommended in a certified CZMP or CMP.

Furthermore, there is additional incentive for Council to prepare a CMP - in that future Coastal and Estuary Grants Program funding for implementation streams will require councils to have a certified CMP in place.

11 THE WAY FORWARD

11.1 Overview of CMP Stages

11.1.1 Stage 2 – Determine Risks, Vulnerabilities and Opportunities

Stage 2 of the CMP involves undertaking detailed studies that help to identify and evaluate the risks, vulnerabilities and opportunities across the estuary system (OEH, 2018e). This stage will involve the completion of the suite of technical studies listed in Section 9.2. The purpose of these studies is to provide information to support decision-making in later stages of the planning process. The Stage 2 process involves:

- *Refining understanding of key management issues;*
- *Identifying areas exposed to coastal hazards and threats to coastal values;*
- *Analysing and evaluating current and future risks through a detailed risk assessment;*
- *Identifying scenarios for social and economic change and related opportunities for coastal communities; and*
- *Where applicable, provide detailed information necessary for a planning proposal to amend the mapping of coastal management areas.*

11.1.2 Stage 3 – Response Identification and Evaluation

Stage 3 of the CMP involves the development and evaluation of potential management options that can address those issues identified in Stage 2 in an integrated and strategic manner (OEH, 2018f). As per the NSW Coastal Management Manual (OEH, 2018f), Stage 3 should contain the following steps:

- *Confirmation of the strategic direction*: This will involve a review of risks and opportunities identified in Stages 1 and 2, in order to ensure that the overall strategic direction of the CMP reflects local values and local/regional strategic planning objectives.
- *Identification of potential management options:* This will involve developing a suite of potential management actions designed to address the issues identified during Stages 1 and 2. This should involve review and collation of options/actions from existing EMP's and CZMPs. Many of these actions are currently ongoing and have been implemented to positive effect, and therefore the derivation of management actions should heavily utilise the foundations laid across the suite of existing management plans. The development of Stage 3 of the CMP should leverage off the significant body of work already undertaken to develop these existing management actions.
- *Evaluation of potential actions:* The various management actions can be prioritised through examining their feasibility, viability and acceptability to stakeholders over a range of timeframes. This should also include clarification of the roles, responsibilities, timing and pathways for the actions. The actions should be evaluated through a detailed cost-benefit analysis and community and stakeholder engagement. As part of this program, relevant stakeholders and the community should contribute to the identification and evaluation of management options and be aware of responsibilities. The options should be understood by all stakeholders in terms of risks, costs and benefits. The Community and Stakeholder Engagement Strategy in Appendix A provides an outline of the engagement activities to be undertaken during Stage 3.
- *Documenting the rationale for management actions:* A business plan should be developed that demonstrates viable funding mechanisms for implementing proposed CMP actions, ensuring that they are consistent with council's IP&R framework (OEH, 2018f).

11.1.3 Stage 4 – Finalise, Exhibit and Certify the CMP

Stage 4 involves the preparation, exhibition and submission of a draft CMP to the Minister for certification (OEH, 2018g). The draft CMP should include the various components laid out in the NSW Coastal Management Manual (2018g), including:

- Snapshot of issues (coastal processes, coastal hazards, threats to biodiversity, resilience and integrity of coastal ecosystems and ecological values etc);
- Actions to be implemented by Council and other public authorities.
- A business plan identifying the full capital, operational and maintenance costs, and timing, of management actions; and
- Mapping of coastal management areas (including any proposed changes to current coastal management areas, or mapping of new coastal vulnerability areas).

The Draft CMP document should, in essence, provide a clear and succinct *statement of proposed coastal management actions* undertaken to meet state, regional and local coastal management objectives. It will outline how actions will be implemented through Council's IP&R framework and the land-use planning systems. Following the completion of a draft CMP, it is likely that DPE will review the draft CMP prior to public exhibition.

Council will then place the CMP on *public exhibition* to seek feedback from all stakeholders in the form of written submissions. It is a mandatory requirement of the NSW Coastal Management Manual that the draft CMP be exhibited for a period of not less than 28 calendar days (OEH, 2018g).

All submissions will be reviewed, considered and if applicable, incorporated into the finalised version of the CMP. The Steering Committee will then review and, if satisfied, endorse the CMP for implementation. This will also need to include approval from relevant agencies identified as having an asset or issue management role in the CMP.

The Steering Committee then submits the CMP to the Minister for certification. The Minister may seek advice from the NSW Coastal Council during this process.

11.1.4 Stage 5 – Implementation, Monitoring and Reporting

The CMP will be implemented by Council following approval, in accordance with their IP&R framework, land use planning system, and Community Strategic Plan. This framework will guide the implementation of the CMP, ensure all required *monitoring and reporting* is completed and will provide a framework for the review and assessment of CMP outcomes (OEH, 2018h). Council should develop and implement a monitoring program for the delivery of the CMP.

The CM Act (section 18(1)) requires that the CMP is reviewed at least once every 10 years, although it should be noted that this may be undertaken sooner, for any reason, including if there are significant new circumstances which need to be considered (OEH, 2018h).

11.2 CMP Forward Program and Cost Structure

A preliminary work plan has been prepared based on the five-stage process for preparing CMPs outlined in the NSW Coastal Management Manual. The work plan includes an outline of the various tasks to be undertaken for each stage of the CMP, the indicative timing required to complete those tasks, and a preliminary estimate of the required budget.

11.2.1 CMP Costing

It should be noted that there are a number of limitations associated with the cost estimates provided for this business case. Consequently, the costs provided in Table 11-1 should be considered as initial estimates, and

indicative only. These costs have been estimated through analysis of the required person-hours needed for each study, based on typical consultancy rates for junior, intermediate, and senior staff. Costs have been cross-referenced with historical project costs across similar environments to ensure robustness (factoring for inflation).

Council will need to consider in-kind costs incurred across the life of the project. Types of in-kind activities may include liaison with internal council departments and councillors, compilation and synthesis of relevant council data, fulfilling data requests, and coordination with the steering committee and consultants – to name just a few. These costs have been estimated at 30% of the projects fees for the various tasks required for Stages 2 to 4. These costs would be absorbed by Council as the project progresses, based on required staff commitment.

11.2.2 CMP Implementation Schedule

A forward program for delivery of the CMP has been developed based on required studies and key milestones. The timeframes provided below consider the following elements:

- The requirements of the community and stakeholder consultation program;
- Timing around Coast and Estuary Grant acquisition; and
- The required timeframes for procurement and facilitation of consultants to undertake the work.

The timing provided herein has assumed that Council will engage a consultant to undertake Stages 3 and 4 as a single package of works – as has been relatively common across the state-wide rollout of CMPs to date. If consultants are to be engaged for Stages 3 and 4 as individual packages of work, additional time will be required in the forward program (for each stage) for the following:

- Preparation of project brief;
- Release of the brief for professional services; and
- The tender process and engagement of a consultant.

Given the uncertainties associated with the above components, the timing provided in the forward program should be considered as indicative only – for the purposes of providing an approximate assessment of where the various project stages are likely to sit within Council's IP&R framework.

11.2.3 CMP Forward Program

The forward program for the CMP is detailed in Table 11-1. This program estimates that the CMP will cost around $300,000 to $345,000 and will require around 12-18 months to develop (See Figure 11-1). The study has not identified any avenues for fast-tracking through the remaining Stages, but rather the existing body of work should provide a basis for the development for Stages 2 to 4.

Table 11-1 Forward Program and Cost Structure for the CMP

CMP Stage	Cost Estimate	Indicative Duration	Indicative IP&R Delivery Plan	Indicative IP&R Operational Plan
Stage 2 – Determine Risks, Vulnerabilities and Opportunities	**$165,000-$210,000**	**3-6 months**	**2022-2026**	**2022/23**
MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment	$80,000 - 100,000	4-5 months	2022-2026	2022/23
Coastal Wetland Mapping and Condition Assessment for Wallis & Smiths Lakes	$50,000 - 60,000	4-6 months	2022-2026	2022/23
Risk Based Framework Assessment for Blackhead Lagoon and Khappinghat Creek	$35,000 - $50,000	2-3 months	2022-2026	2022/23
Stage 3 – Identify and Evaluate Options	**$85,000**	**4-6 months**	**2022-2026**	**2023/24**
Stage 3 Community and Stakeholder Engagement	$20,000	3 months	2022-2026	2022/23
Stage 3 CMP Management Actions Report	$65,000	3-5 months	2022-2026	2022/23
Stage 4 – Prepare, Exhibit, Finalise and Adopt CMP	**$50,000**	**5-7 months**	**2022-2026**	**2024/25**
Stage 4 Draft Coastal Management Program	$30,000	3-5 months	2022-2026	2024/25
Stage 4 Community and Stakeholder Engagement	$10,000	2 months	2022-2026	2024/25
Stage 4 Final Coastal Management Program	$10,000	1 month	2022-2026	2024/25
Total	**$300,000 -$345,000**	**12-18 months**	**As above**	**As above**

CMP Stages	Duration	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24
Stage 2 – Determine Risks, Vulnerabilities and Opportunities	**3-6 months**																						
MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment	4-5 months																						
Coastal Wetland Mapping and description, for for Wallis & Smiths Lakes	4-6 months																						
Risk Based Framework Assessment for Blackhead Lagoon and Khappinghat C	2- 3 months																						
Stage 2 Community and Stakeholder Engagement																							
Stage 3 – Identify and Evaluate Options	**4-6 months**																						
Stage 3 Community and Stakeholder Engagement	3 months																						
Stage 3 CMP Management Actions Report	3-5 months																						
Stage 4 – Prepare, Exhibit, Finalise and Adopt CMP	**5-7 months**																						
Stage 4 Draft Coastal Management Program	3-5 months																						
Stage 4 Community and Stakeholder Engagement	2 months																						
Stage 4 Final Coastal Management Program	1 month																						
Total	**12-18 months**																						
Council investigations through IP&R framework, EP&A framework (LEP and DCP) and CM SEPP if necessary.																**Document review period 5- 7 years (2027-2029).**							
					Stage 2			Stage 3			Stage 4			Final Delivery									

Figure 11-1 Timeline for the Stages 2-4 of the Southern Estuaries CMP

11.3 Planning Proposals

The mechanism by which a LEP is made or amended is via a *planning proposal* – which is a document that explains the intended effect of a proposed LEP and sets out the justification for making that plan (DPE, 2016).

Sections 3.33 to 3.37 of the EP&A Act outline the processes, including the preparation of a document explaining the intended effect and the justification for the proposal. The Act requires that a planning proposal includes stated objectives, an explanation of the provisions to be included in the instrument (in this case the LEP), the justification of those provisions, details of community consultation undertaken, and maps which show the proposed application of the changes.

To assist this process, DPE has published a *Guide to Preparing Planning Proposals* (DPE, 2016) which outlines the requirements in respect of content and process for a planning proposal.

As part of this process, the Minister for Planning (or their delegate) can issue a *Gateway determination*. It specifies whether a planning proposal is to proceed and if so, in what circumstances. The purpose of the Gateway determination is to ensure there is sufficient justification early in the process to proceed with a planning proposal. The Gateway determination will confirm the information (which may include studies) and consultation required before the LEP can be finalised. A planning proposal overview for the CMP is provided in Table 11-2.

Table 11-2 Planning Proposal Overview for Coastal Management Areas

Coastal Management Area	Planning Proposal Overview at Stage 1 of CMP
Coastal Environment Area	The Stage 1 Scoping Study has not identified that the CM SEPP Maps for these coastal management areas need to be amended. However, a future planning proposal to update the Coastal Wetlands and Littoral Rainforests Area may be actioned in later stages of the CMP if the outcomes of the Stage 2 mapping study deem it necessary.
Coastal Use Area	
Coastal Wetland or Littoral Rainforest	
Coastal Vulnerability Area	At the time of preparing this Scoping Study, there was no map published under the CM SEPP to identify the CVA across the estuary system. Therefore, a planning proposal will be required to prepare an LEP which declares a map (based on the outcomes of the CMP) to be a CVA for the purposes of the CM SEPP.

11.4 Implementation

Following approval of the Stage 4 CMP document, Stage 5 of the CMP will be implemented through Council's IP&R framework, and their Community Strategic Plan – with implementation through their Delivery Programs and Operational Plans. This framework will guide the implementation of the CMP and ensure all required monitoring and reporting is completed. It will also provide a framework for the review and assessment of CMP outcomes. Figure 11-2 below shows how the CMP process informs, and is informed by, the elements of the IP&R framework as per the CM Manual.

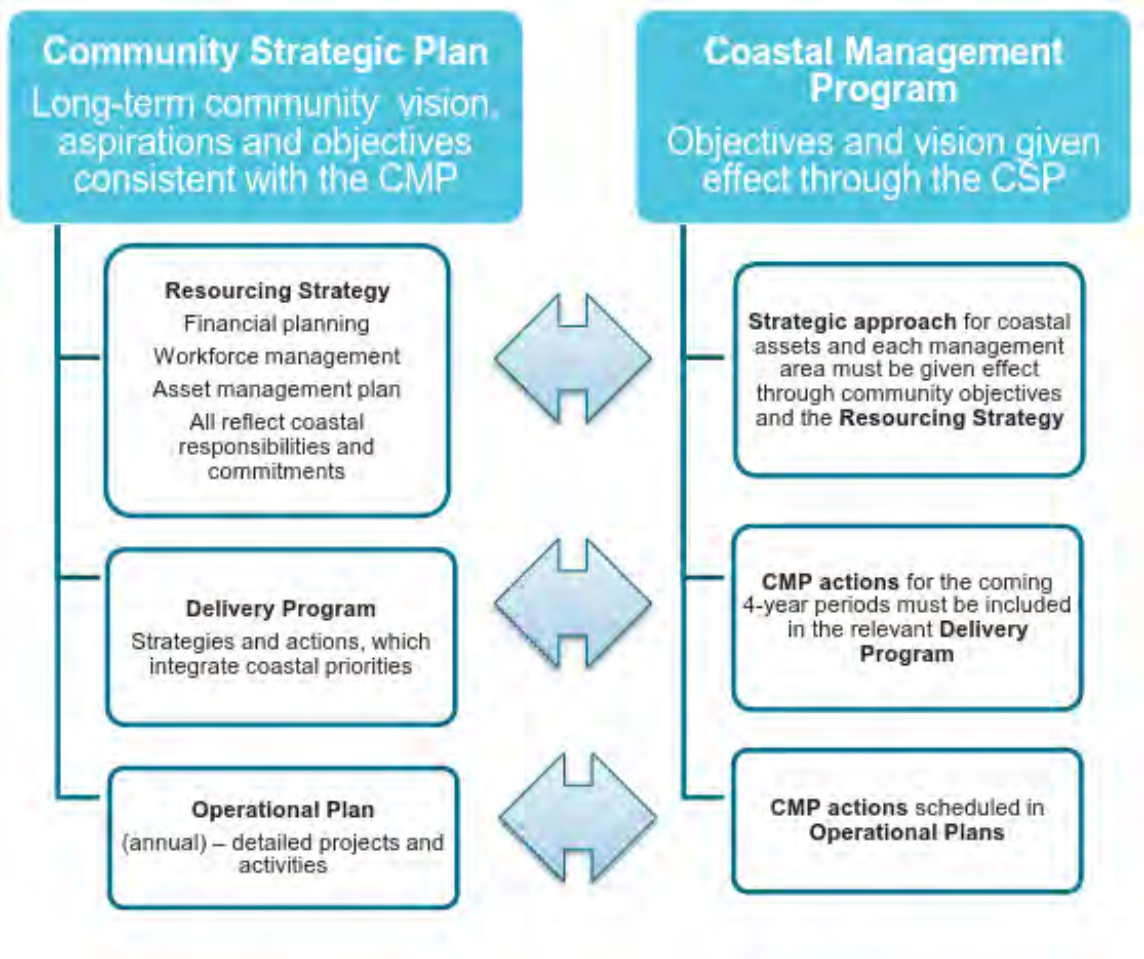

Figure 11-2 Relationship Between the IP&R Framework and the CMP (source: OEH, 2018h)

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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

APPENDIX A
COMMUNITY AND STAKEHOLDER ENGAGEMENT STRATEGY

MIDCOAST council

SOUTHERN ESTUARIES COASTAL MANAGEMENT PROGRAM

COMMUNITY AND STAKEHOLDER ENGAGEMENT STRATEGY

CONTENTS

INTRODUCTION

The Southern Estuaries of the MidCoast region are one of its greatest assets. They strengthen the MidCoast economy and provide social and recreational values that benefit the people that live, visit and work in the region. They contain areas of social and cultural significance. They are home to a passionate local community, who care deeply about the utility and management of these estuaries.

The Southern Estuaries Community and Stakeholder Engagement Strategy has been prepared according to guidelines issued by the NSW Government titled 'Guidelines for community and stakeholder engagement in coastal management'. This strategy will ensure that interested stakeholders have the opportunity to provide input to and engage in developing the Coastal Management Program (CMP). It will ensure Council understands the community's values and vision for the southern estuaries and allow them to provide knowledge, feedback and connection to CMP management actions.

A variety of stakeholders will be involved in the development of the Southern Estuaries CMP, each with a different level of knowledge and influence. Stakeholders have been categorised into four different groups: community, special interest groups, key stakeholders and delivery partners.

The community of our Southern Catchments is diverse and, as such, there is limited value in using a 'one size fits all' engagement approach. We commit to providing people with multiple ways to access and engage with the development and implementation of the Southern Estuaries CMP. To enable this, we will also commit to taking the time to work with stakeholders who may be harder to reach for reasons such as language and cultural differences, disability and geographical location.

A community profile of the MidCoast Local Government area was conducted using 2016 Census data and is provided in Chapter 5.3 of the Stage 1 Scoping Study Report. The main findings are:

- There is a higher median age, a lower proportion of people in the younger age groups (15 years of age or younger) and a higher proportion of people in the older age groups (60+ years) compared to the NSW average. Areas with a high percentage of retiree-aged populations (65 years and over) include Forster, Tuncurry, Coomba Park, Tea Gardens and Hawks Nest.
- There is a lower percentage of households with couples with children compared to the NSW average.
- There is a higher percentage of Aboriginal and Torres Strait Islander population compared to the NSW average. There are areas with a relatively high Aboriginal population in Forster.
- There is a relatively high percentage of people born in Australia and most only speak English at home.
- There is a relatively high level of home ownership with less than a quarter of households renting.
- Less than 10% of the population has a bachelor's degree or higher.
- The income per person is considerably less than the state average. Areas with relatively high proportions of low-income households include Tuncurry, Forster, Coomba Park, Tarbuck Bay and Hawks Nest.

The Southern Estuaries Engagement Strategy has been designed to meet the needs of these groups using a range of methods outlined on the following page (Figure 1).

This strategy is consistent with MidCoast Council's Community Engagement Strategy and the mandatory requirements for community and stakeholder engagement required by the Coastal Management Act 2016.

The goal of the strategy is to ensure that there is:

- confidence in the management actions identified
- clarity on community values, and
- all stakeholders are confident that their input has been considered.

SOUTHERN ESTUARIES COASTAL MANAGEMENT PROGRAM
ENGAGEMENT OVERVIEW

WHO

COMMUNITY
Residents
Recreational Fishers
Rural and Urban Landholders
Indigenous Community
Schools and educational institutions

SPECIAL INTEREST GROUPS
Environmental Interest Groups
Beef, Diary and Oyster Farmers
Professional Fishers
Recreation Clubs
Business & Tourism Networks
MidCoast 2 Tops Landcare
Karuah Great Lakes Landcare

KEY STAKEHOLDERS
Councillors
EMANEX/MANEX
MCC Staff
DPE (Science Unit)
DPE (Water, Floodplains & Coast) Scientists
Local Aboriginal Land Councils
Port Stephens Council

DELIVERY PARTNERS
Hunter LLS
NPWS
DPI-Marine Parks
Crown Lands
Forests NSW
Office of Water
DPI - Fisheries
Transport NSW
Indigenous Service Providers

WHY

To understand their values and vision. Identify risks, provide feedback on actions.

Identify risks and management options. Provide input on feasibility, viability and acceptability of actions.

To develop actions and commitment to actions which will address the risks to estuary values.

HOW

ONLINE AND POPUP SURVEYS
Online survey with interactive map in stages 1 and 3. The first survey will seek input on values and vision for our estuaries and identify issues. The second survey will seek input on management options to test acceptability.

COMMUNITY EVENTS AND DROP IN SESSIONS
Share the science presentations, community event days and drop in sessions will be used to inform and consult the community and visitors in stages 1, 2 and 3.

WORKSHOPS AND STAKEHOLDER MEETINGS
A reference group of representative stakeholders will be established to provide input throughout stages 2-4. A technical working group of scientists and delivery partners will be established to provide technical input from stages 1-4. Targeted meetings will be held with special interest groups and delivery partners to provide input in stages 1-4.

KEY CONSIDERATIONS
- The requirements for engagement in the NSW Coastal Management Manual are met
- All voices need to be heard and considered
- Acknowledging the achievements of stakeholders delivering actions in existing plans
- Demonstrating how the Coastal Management Program is complementary to other government strategies

WHAT

An engagement outcomes report will accompany the Coastal Management Program.

COUNCIL
Recommendations to Council at each stage of the program incorporating community and stakeholder input

STAFF
Feedback that can be used to inform the preparation of the draft management actions

Feedback on the draft management actions to inform the final Coastal Management Program

STAKEHOLDERS
A summary of feedback will be available to participants

Engagement outcomes and how they informed the actions will be included in the Coastal Management Program

HIGH LEVEL OUTCOMES

01 Council: Confidence in management actions

02 Staff: Clarity on community values and acceptability of actions

03 Stakeholders: Confidence in the process. Input has been considered

WE ARE HERE

Stage One : Scoping Study → Stage Two: Technical Studies → Stage Three: Options Assessment → Stage Four: CMP Finalisation/ → Stage Five: Implementation and Evaluation

Figure 1: Southern Estuaries Coastal Management Program Engagement Overview

BACKGROUND

Under the Coastal Management Act 2016, Council is required to prepare one or more Coastal Management Programs (CMPs). A CMP sets out the long-term strategy for the coordinated management of the coastal and estuarine zone with a focus of fulfilling the objectives of the Coastal Management Act 2016. The preparation of a CMP for the Southern Estuaries will aid MidCoast Council to identify, understand, prepare for and respond to the current and emerging risks impacting on estuarine environments.

The Act (Section 16) requires Council to consult with the community and stakeholders before adopting a CMP. Part A of the Coastal Management Manual includes statutory provisions and mandatory requirements relating to community and stakeholder engagement, which are addressed in this engagment strategy. The CMP comprises a five-stage development process (Figure 2) and Council will engage with its community at each stage. A Stage One Community and Stakeholder Engagement Plan was prepared during stage 1 and is attached to this document as Appendix A.

This engagement strategy outlines Council's plans for ongoing community and stakeholder engagement during stages 2-5 of the CMP process. This plan is also required to deliver on the needs of Council's Community Engagement Strategy, a requirement of the *Local Government Act*.

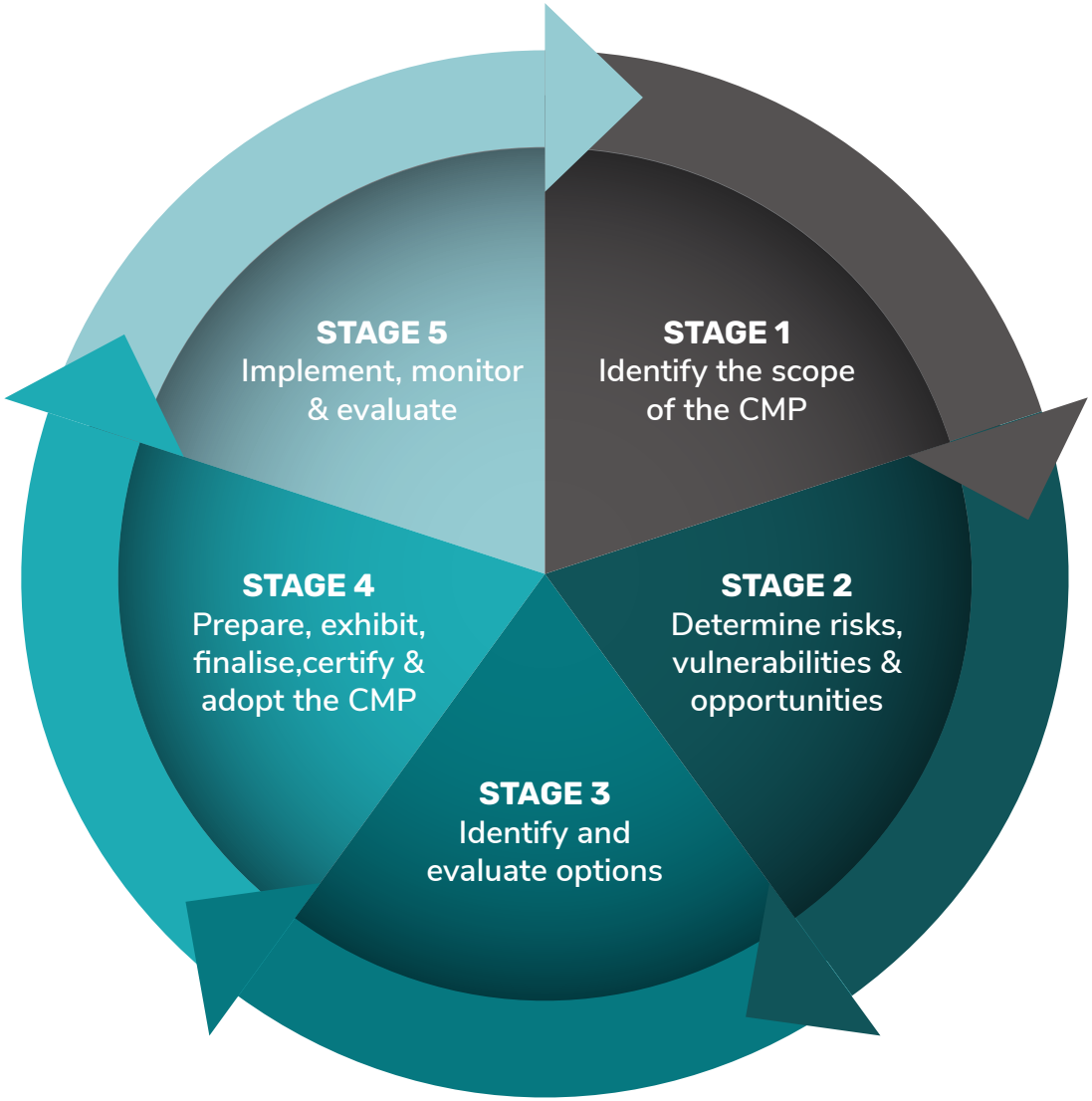


Figure 2: Development of a CMP is a 5-stage process

ENGAGING WITH OUR COMMUNITY

MidCoast Council aims to engage with community stakeholders in an effective, timely and transparent manner to foster collaboration, cooperation and increased understanding on issues that affect them. Council will ensure that community views are considered in the decision-making process.

We recognise that the level and extent of engagement must vary according to the nature, complexity and level of impact of the decision in question. Our Southern Estuaries Community and Stakeholder Engagement Strategy will enable local communities to participate in the planning, management and prioritisation processes that will help improve land management, community wellbeing, water quality, social, cultural and economic value and the ecological health of the estuaries.

Principles that shape our engagement approach

Trust will be the foundation for the success of this engagement strategy. Trust will be built by delivering engagement aligned with MidCoast Council's guiding principles (Figure 3). We will develop relationships and demonstrate to the community that we value their input and participation.

Timely	Early in the project timeline prior to key decisions being made
Accessible	Open and available with strategies in place to reach across the community
Broad	Strategies for ensuring representation from across the entire community
Accurate	Feedback collected, interpreted correctly and reported clearly
Meaningful	It is clear how input had contributed to decision making
Transparent	Community understands the process and sees how their input is used
Genuine	The input sought has a purpose and is used to inform decisions
Responsive	Community dialogue continues throught the process, to outcome

Figure 3:
Principles for stakeholder engagement in the CMP

Other engagement considerations

The Southern Estuaries Community and Stakeholder Engagement Strategy recognises that social factors are the foundation upon which the successful achievement of natural resource management relies. In recognition of this other considerations relating to social science underpin our Engagement Strategy, as follows.

Emotions underpin decision making

Emotions are powerful drivers of decision-making. Successful decision making depends on understanding the intentions, emotions and beliefs of others. When engaging with the MidCoast community we will take the time to listen to what people are concerned about and encourage conversations where issues can be raised and discussed. We commit to not rushing decisions, to respecting a range of opinions, and to developing participative decision-making processes that encourage involvement.

Our place and culture are intertwined

Our values and behaviours play a role in shaping culture. Values are a key starting point for changing behaviour, and act as enablers to the achievement of outcomes. We know that our Southern Estuaries are valued by the community because of the importance placed on the Environment - both land and water - within MidCoast Councils Community Strategic Plan and vision. 'Our Environment' is one of five central values to the Community Strategic Plan, and reflects the interdependence of place, culture and behaviour.

During stage 1 of the program, a community survey was completed with 243 responses received. The range of community values identified in this process will be utilised during stages 2-5 of the CMP development.

One of the central aims of The Southern Estuaries CMP is to develop a culture of 'custodianship' using shared values as a starting point to build common understanding, trust and commitment in order to facilitate plan implementation through behaviour change.

Social and natural capital are linked

Social capital has been defined as the 'networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit' (Putnam, 1995). It consists of those bonds created by belonging to a group that instils trust, solidarity, and cooperation among members.

Social capital (people, networks, relationships) and natural capital (ecosystems, environment, nature) are intrinsically linked. Changes in ecosystems can impact trust, involvement, and cohesion within communities by altering human-environment relationships. For example, the economic and public health costs associated with damage to ecosystem services can be substantial. Conversely, strong social bonds at the community level can enhance ecosystem services and the success of environmental management programs.

When people are well-connected and their knowledge is sought, incorporated and built upon during planning and implementation, they are more likely to sustain stewardship and protection of natural resources.

The engagement components of the Southern Estuaries CMP will create conversations which strengthen the relationship between social and natural capital in order to foster sustainable catchment and estuary management.

SCALE OF ENGAGEMENT

Council's Community Engagement Strategy 2019-2022 provides a matrix that describes four levels of engagement, with each level dependent on the scale and nature of the project. According to the matrix, the Southern Estuaries CMP is a 'level 3' project. This means we will apply the following approach:

- Work with stakeholder groups to identify a comprehensive stakeholder information program to satisfy community concerns and information needs.
- Consult with the community, working to understand and take into consideration the interests, aspirations and concerns of the community.

Stakeholders and level of engagement

The Southern Estuaries CMP will build on engagement previously undertaken as part of catchment and estuary management in the region, including the development of documents such as the Water Quality Improvement Plan, Wallis and Smiths Lake CZMPs and Karuah Catchment Management Plan. It will also consolidate and improve established partnerships with agencies including National Parks and Wildlife, Local Land Services and community groups including Landcare and the Wallis and Smiths Lake Coast and Estuary Committee.

In order to more effectively target our engagement, stakeholders have been grouped into four categories; Community, Special Interest Groups, Key Stakeholders and Delivery Partners. These groupings are based on broadly shared values and interests among the stakeholders in each category. The aim and constitution of each category is shown below. Additional information on each of these groups is included in the stakeholder matrix (Appendix B).

Community

Aim - To understand their values and vision. Identify risks, provide feedback on actions.

- Residents, in particular those that utilise the estuarine areas
- Recreational fishers
- Rural and urban landholders
- Indigenous community members
- Schools and other educational institutions

Special Interest Groups

Aim - Identify risks and management options. Capture and integrate local knowledge. Provide input on feasibility, viability and acceptability of actions.

- Environmental Interest Groups
- Beef, Dairy and Oyster Farmers
- Professional fishers
- Recreation Clubs
- Business & Tourism networks
- MidCoast 2 Tops Landcare network
- Karuah Great Lakes Landcare network

Key Stakeholders

Aim - Identify risks and management options. Capture and integrate scientific, cultural and professional knowledge. Provide input on feasibility, viability and acceptability of actions.

- MCC Councillors
- MCC GM and Directors (EMANEX)
- MCC Leadership Group and Management (MANEX)
- MCC Staff
- Department of Planning and Environment (Science unit)
- Department of Planning and Environment (Water floodplains and coast)
- Scientists
- Local Aboriginal Land Councils
- Port Stephens Council
- Emergency Services

Delivery Partners

Aim – To develop actions and commitment to actions which will address the risks to estuary values.

- Hunter Local Land Services
- Department of Planning and Environment (Crown Lands)
- National Parks and Wildlife Services
- Forests NSW
- Office of Water
- DPI – Fisheries
- DPI – Marine Parks
- Transport NSW
- Indigenous Service Providers

NB: Delivery partners will include any organisation who have ultimate responsibility for actions in the plan, this list is an approximation at this stage, some of these stakeholders may fit better within the key stakeholders list.

Engagement activities will enable these groups to provide input to the CMP. Specific types of activities and messages will be designed to target the various stakeholders, as described further in this strategy.

Culturally appropriate engagement with traditional indigenous owners and the Local Aboriginal Land Councils (LALCs) is an important part of the preparation of a CMP. It is valuable to understanding the cultural significance of the coastal landscape and the influence that coastal processes, hazards and environmental change may have on the values of physical and non-physical elements of cultural heritage. There are two Local Aboriginal Land Councils located within the Southern Estuaries, Forster LALC and Karuah LALC. Other indigenous groups in the study area such as the Lakkari Aboriginal Native Title group and representative elders will also be involved in the engagement process.

Some parts of our community will be more difficult to reach than others, and we will design our approach to ensure a diverse range of stakeholders participate. As outlined in MidCoast Council's Community Engagement Strategy our engagement approach utilises the five-point framework developed by the International Association for Public Participation (IAP2) and shown in Figure 4:

Engagement in Stages 2-4 of the process will focus on informing, consulting, involving and collaborating, with the overall aim of empowering our community to implement the program during stage 5.

A range of engagement tools will be utilised as part of the process and will include those listed in the Guidelines for community and stakeholder engagement in coastal management as well as additional tools identified by Council through their community engagement strategy.

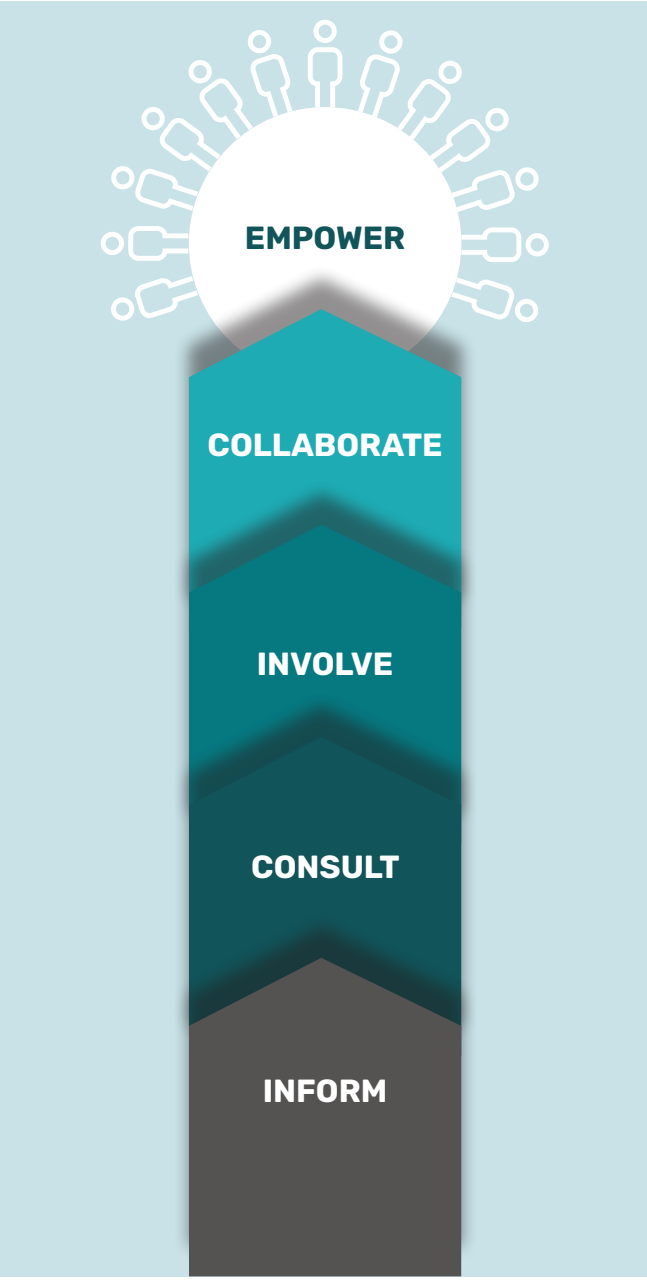


Figure 4: The Public Participation Spectrum, where 'inform' is the lowest level of engagement, and 'empower' is the highest.

Empower – place final decision making in the hands of the community

Collaborate – partner with the community in each aspect of the decision including the development of alternatives and the identification of a preferred solution

Involve – work directly with the public throughout the decision-making process to ensure that community concerns and aspirations are consistently understood and considered

Consult – obtain public feedback on alternatives, projects, designs, options

Inform – provide the public with balanced and objective information to assist in understanding the problem, benefits and solutions

GOVERNANCE STRUCTURE

Engagement for the preparation of the Southern Estuaries CMP will be led by MidCoast Council's Natural Systems Team. A governance structure with three groups will foster integration between delivery partners, community, key stakeholders, special interest groups and Council teams and provide ongoing technical advice and community collaboration. The groups are described below, and the governance structure is shown in Figure 5.

Southern Estuaries CMP Reference Group: A reference group of representative stakeholders will be established to provide input throughout stages 2-4. The reference group will be made up of a mixture of community, key stakeholders, delivery partners and special interest groups.

Southern Estuaries CMP Technical Working Group: Technical advice will be provided by the Southern Estuaries Technical Working Group. The working group will be comprised key stakeholders and delivery partners.

Southern Estuaries CMP MCC Internal Working Group: MidCoast Council staff from a variety of different divisions will provide expertise and feedback on management options. The group will include staff from the Natural Systems, Strategic Planning, Water Services, Engineering and Engagement teams.

More information on the representatives in each group is provided in Appendix C.

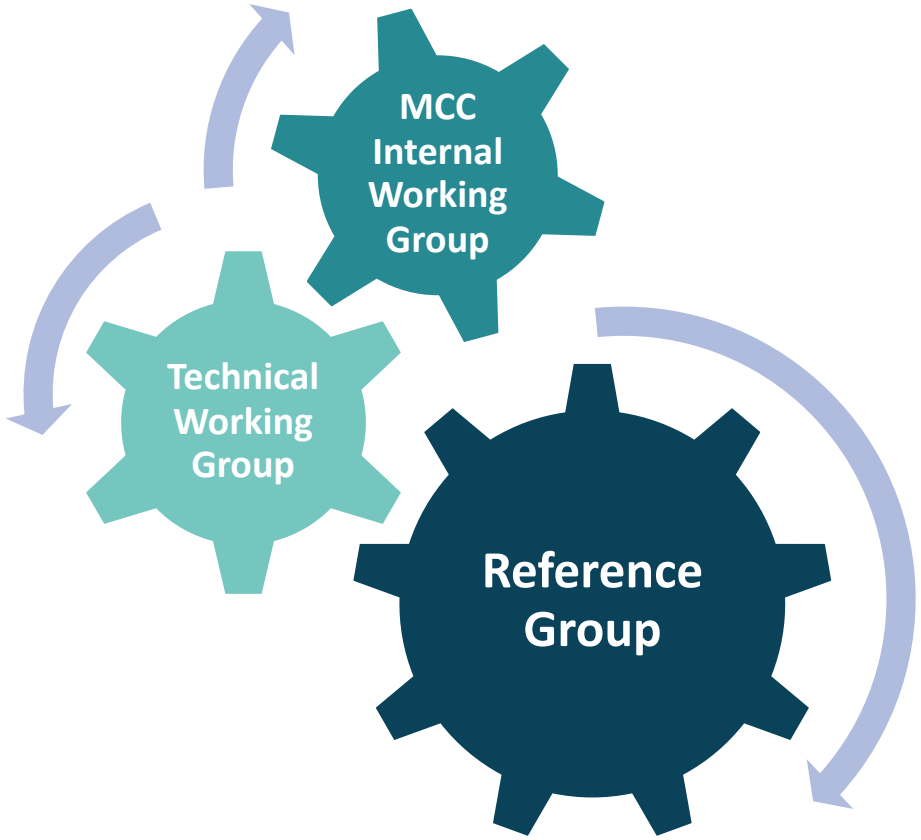


Figure 5: Governance Structure for Southern Estuaries CMP

COMMUNITY VALUES AND ISSUES

A variety of community engagement activities were undertaken during stage 1 of the CMP process, including a community survey, workshops with the Technical Working Group and Internal MCC Working Group, values mapping exercise, community events and one-on-one engagement.

From analysis of community engagement in previous studies and plans, and findings from community engagement in stage 1, some of the most highly rated values identified included sustaining healthy estuarine environments that support biodiversity, good water quality that supports ecosystems and recreational uses, and scenic and recreational amenity.

The main uses identified through the survey were:

- Nature observation (enjoying the scenery, birding)
- Walking, running or other exercise
- Picnics/barbecues
- Recreation on the water (kayaking, canoeing, sailing, recreational fishing from a boat)

The information from stage 1 was utilised in the preparation of this engagement strategy. A full report of the community and stakeholder engagement conducted in stage 1 is detailed in the Community and Stakeholder Engagement Strategy provided in Appendix A of the scoping study report.

ENGAGEMENT RISK MANAGEMENT

IAP2 promotes assessment of potential engagement risks and how these will be managed. Risk management for the CMP engagement program is shown below.

Table 1

Risk	Risk management methods
Engagement fatigue in the community	Community and stakeholder engagement has been undertaken during the development of the Wallis and Smiths CZMPs, Karuah Catchment Management Plan, Water Quality Improvement Plan and most recently the Manning CMP. Therefore, there is a need to carefully consider and manage engagement fatigue within the community. This can be achieved by explaining the relationship between the plans (eg catchment and estuary plans) and the need to review the existing CZMPs given their age and the Coastal Management act requirements. It will also be important to ensure stakeholders understand that their input has assisted in creation of the plan.
Community frustrated by planning and 'perceived' lack of action	Provide context for plan development as providing strategic direction for estuary management and as a tool for identifying actions with the greatest impact to address the highest risks. Promote the achievements of catchment and estuary management actions over the past 20 years in any communication about the CMP. Identify the plan as a tool for building on the achievements to date. Ensure participants are aware of how their input has been utilised and what outcomes it has lead to.
Apathy/ lack of interest	Always promote the 'why' of CMP development indicating how input from the community will be used Utilise a range of engaging communication methods that will suit different audiences (see 'engagement ideas bucket' in Appendix D. When using methods such as social media posts, project bulletins, media releases to encourage community interest use story telling techniques, connect with identified community values Provide engagement opportunities close to resident's home, make contact with the community through community groups and local networks Proactive engagement with special interest groups indicating how their input can influence the actions in the plans and what the plans can deliver for them Engage people about CMP development at events that are not directly related to the CMP (eg boat tours of environmental projects, biodiversity events, community events – see 'engagement ideas bucket' Appendix D.
Climate change scepticism	Provide official scientific climate change projections regardless of sceptics' views Do not enter into climate change debates – refer to Council, NSW Government stance Use key messages and materials developed by Hunter Regional Councils project on climate change / adaptation
Dominant characters/ viewpoints	These issues will mainly arise with the Committee and Council workshops as other engagement is online or in-person Use strong facilitation skills to manage dominant characters/viewpoints in these settings
Anxiety re outcomes of CMP	Assure participants that they will be able to provide input in Stage 3 and review the draft CMP including all proposed management actions Those with concerns can liaise in more detail with Council staff
Community raise issues and concerns that will not be covered by a CMP	Provide clear information about what is covered in a CMP, provide very specific guidance on what input we are seeking and why when asking for feedback from the community. Establish key messages for each stage of CMP development. Ensure that issues that are outside of the CMP scope are passed onto the relevant sections of Council to address through service requests
Council, Council executive, project partners do not commit to / support actions identified in the plan	Engage operational staff through their involvement in the technical working group and MCC working group to inform actions identified in the plan. Ensure that the plan reflect the results of the community engagement and thus reflects community desires as well as the technical feasibility and viability. Undertake targeted engagement with management (Council EMANEX and project partners) and Councillors throughout the project.

SCOPE OF ENGAGEMENT

Stage One Engagement Strategies

Engagement for Stage One of the CMP is provided in Appendix A.

Stage Two Engagement

Table 2

Engagement outcomes	Stakeholders	IAP2 Spectrum	Content & messages	Engagement Tools
Special interest groups and key stakeholders understand how they can be involved in the preparation of the program.	Special Interest Groups (Business and Tourism Networks, Beef, Diary and Oyster Farmers, Professional Fishers) Key Stakeholders (Local Aboriginal Land Councils) Delivery Partners (Indigenous Service Providers)	Inform, Consult	The intent of the CMP and opportunities for stakeholders to be involved in the planning process. Input on emerging issues and vision for the CMP.	Focus groups (workshops with special interest groups), 1:1 engagement.
Increase community understanding of CMPs, result of Stage 2 studies and the next steps in program development.	Community (All) Special Interest Groups (All) Key Stakeholders (All) Delivery Partners (All)	Inform	The NSW coastal management framework and the role of CMPs. Information on the results of Stage 1, community survey, results of Stage 2 studies and set the scene for Stage 3. Increase community trust in the science.	Web based information (Have your Say website), printed material in newsletters, fact sheets, local paper or newsletters (media releases, Creek to Coast Newsletter, News Wrap Newsletter), Social Media posts, 'Share the Science' community events, Councillor Bulletin, Presentation to Councillors.
Key stakeholders, special interest groups and delivery partners are involved with the preparation of the program as a precursor for formal commitment to future actions.	Delivery partners (agencies), MCC Staff, technical working group and reference group.	Involve, Collaborate	The intent of the CMP, opportunity for stakeholders to be involved, commitment is required for identified actions, refining first pass risk assessment, setting the scene for Stage 3 and information on the results of stage 2 studies.	Focus groups (establish the reference group, workshops with technical working group and reference group, MCC Staff, targeted meetings with delivery partners)
MCC staff provide technical guidance and have confidence in Stage 2 studies (wetland mapping, tidal inundation).	MCC Staff (Engineering, Land use Planning, Natural Systems)	Involve, Collaborate	These studies are multi-disciplinary in nature and the results will influence management decisions across departments.	Focus groups (establish multi-disciplinary project team to guide project), discussion within the Technical Working Group

Stage Three Engagement Strategies

Table 3

Engagement outcomes	Stakeholders	IAP2 Spectrum	Content & messages	Engagement Tools
Develop and strengthen strong working partnerships to identify potential management actions	Community (All) Special Interest Groups (Landcare, Beef, Diary and Oyster Farmers, Environmental Interest Groups) Key Stakeholders (Local Aboriginal Land Councils) Delivery Partners (Indigenous Service Providers)	Involve, Collaborate	Environmental outcomes are more achievable when working together	Discussion within the coastal management advisory groups (workshops with Technical Working Group, Internal Working Group and Delivery Partners. Outcomes reviewed by reference group), Specific issue or locality working groups or engagement processes (Utilise existing partnerships including LLS and Landcare MOUs)
Managers within council aware of coastal hazards, threats, risks and vulnerabilities, opportunities and actions relevant to their responsibilities and potential conflict with other council priorities	Key Stakeholders (MCC Staff, EMANEX/MANEX)	Inform, Consult	Awareness of linkages across Council divisions of identified risks and management actions. Awareness of the need to identify actions and include them in DPOP	Specific issue or locality working groups or engagement processes (workshops with Internal working group, additional internal Council staff and EMANEX)
Delivery partners contribute to identification and evaluation of management options, are aware of responsibilities and accept the adaptive nature of the CMP	Key Stakeholders (MCC Staff, EMANEX/MANEX) Delivery Partners (All)	Consult, Involve	Section 16 of the CM Act requires that councils consult with public authorities if the CMP proposes actions or activities to be carried out by that public authority or if the CMP relates to, affects or impacts on any land or assets owned or managed by that public authority	Facilitated workshops (with relevant agencies and managers to discuss management actions and their responsibilities, technical working group and Internal working group workshop, EMANEX briefing)
Robust options, understood by all stakeholders in terms of risks, cost and benefits	Community (All) Special Interest Groups (All) Key Stakeholders (Local Aboriginal Land Councils, MCC Staff, EMANEX/MANEX) Delivery Partners (All)	Inform, Consult, Involve	Options backed by data and reflect community values	Web-based and social media information and engagement (Have Your Say website, online survey and mapping exercise), Facilitated workshops (reference group to review management options), Specific issue or locality working groups or engagement processes (continued dialogue with LALC and Aboriginal Service providers, councillor workshop)
Council understands stakeholder views about cost-benefit distribution, willingness to pay and potential trade-offs	Key Stakeholders (Councillors, EMANEX/MANEX)	Inform, Consult	Council understands stakeholder views and implications for the choice of management options, community provide input to acceptability of management options.	Specific issue or locality working groups (Internal working group to review stakeholder views and implications for management options, Councillor and EMANEX briefings).

Stage Four Engagement Strategies

Table 4

Engagement outcomes	Stakeholders	IAP2 Spectrum	Content & messages	Engagement Tools
Community and stakeholder support for actions and priorities in the CMP	Community (All) Special Interest Groups (All) Key Stakeholders (MCC Staff, Local Aboriginal Land Councils) Delivery Partners (All)	Inform, Consult,	It is a mandatory requirement that a draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP Community and stakeholder engagement guidelines applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days, before it is adopted.	Exhibition roll-out to be determined at the time that the draft is prepared. so that it can be based on the lessons learnt from engagement during stages 1-3.
Increased awareness about funding options and how CMP implementation will be integrated with council's DPOP	Key Stakeholders (MCC Staff, Councillors, EMANEX/MANEX)	Inform, Consult	Recognition of multiple funding sources for the coastal zone. Identification of integration into Council's DPOP. Recognition of funding and resourcing limitations.	Use internal council working groups to facilitate and raise awareness of funding options and integration of the CMP. Council and MANEX briefings
Special interest groups and delivery partners are involved with the preparation of the program and make formal commitment to identified actions	Special Interest Groups (Landcare) Key Stakeholders (MCC Staff) Delivery Partners (Local Land Services, Transport for NSW, Crown Lands, National Parks and Wildlife Services, Indigenous Service Providers)	Involve, Collaborate	The intent of the CMP, opportunity for stakeholders to be involved, Environmental change is more achievable when we work together, commitment is required for identified actions.	Targeted meetings with delivery partners and technical working group
Key Stakeholder review of draft documents	Key Stakeholders (All)	Involve, Collaborate	Environmental change is more achievable when we work together, commitment is required for identified actions.	Review of document by key stakeholders and information incorporated.
Investment in the CMP leading to adoption by Council and final certification	Key Stakeholders (Councillors, Department of Planning and Environment (Science Unit), Department of Planning and Environment (Water, Floodplains and Coast) Minister for Environment	Inform, Consult	There is understanding of and confidence in the plan and identified management actions.	Councillor Briefings

Stage Five Engagement Strategies

Table 5

Engagement outcomes	Stakeholders	IAP2 Spectrum	Content & messages	Engagement Tools
Community understanding of how CMP will be implemented	Community (All) Special Interest Groups (All)	Inform	Outline integration and roles and responsibilities for Council and public authorities. Stress shared responsibility and that all are involved e.g. behaviour change	Web-based and social media information and engagement (Council website, Community events, media releases, social media, Creek to Coast, News Wrap and other established methods)
Community informed about progress on actions	Community (All) Special Interest Groups (All)	Inform	Community initiative – the need to continue to work together on actions	Web-based and social media information and engagement (project page on the website, media releases, social media, Creek to Coast, News Wrap and other established methods) Community event days.
Continue partnership with community by creating opportunities for community involvement in implementing, monitoring, evaluating and reporting CMP effectiveness	Community (All) Special Interest Groups (All)	Inform, Involve, Collaborate	Reporting measured improvements	Implementation of citizen science programs, community event days and other community engagement opportunities as laid out in the CMP
Maintain and enhance partnerships across public authorities and also to seek opportunities to leverage off other programs	Delivery Partners (All)	Involve, Collaborate,	Importance of maintaining and enhancing partnerships	Utilise existing MOUs and look for other opportunities to continue growing relationships with Partner Agencies.
Continue partnership with delivery partners through implementing, monitoring, evaluating and reporting on CMP management actions	Delivery Partners (All)	Empower	Implementation of management actions	Implement the co-ordinated delivery plan

In addition to the above tables an 'engagement ideas bucket' has been prepared and is presented in Appendix D.

FLEXIBILITY

This engagement strategy outlines how Council intends to listen to our community. As new information is gained, or concerns are raised by the community, the engagement strategy can be revised as required. We will remain agile enough to take advantage of the opportunities and changing circumstances that may arise.

COMMUNICATIONS TOOLS AND CHANNELS TO SUPPORT ENGAGEMENT

The following communications tools and channels will be used to support engagement:

Table 6

Method:	Timing:	Details:
Website	Throughout	Raise awareness of engagement and provide information on the project and how to participate through the establishment and regular updating of the Have Your Say Page.
Media release	Prior to milestones, to promote events and engagement opportunities	Issued to print, radio, and television contacts in a timely manner to help inform the community of the project and feedback opportunities
Email to community database	Throughout	Use our community databases to target stakeholders from specific interest groups or geographical locations, to raise awareness, invite participation and canvas views
Posters	To promote events and engagement opportunities, prior to and during the public exhibition	To raise awareness of engagement and inform the community where to find information and how to participate. Possible locations include Council offices, libraries, community centres, sporting grounds and open spaces where communities gather
Survey	During stages 1 and 3 of the program	In addition to providing input via email, there is the opportunity to participate in the development of the strategy through several online surveys
Flyers (hard copy and electronic)	Prior to engagement opportunities	Distributed at specific events or via email distribution lists, to invite participation and drive traffic to the website. Include QR code to participate in a survey, workshop, etc
Media interviews (print and radio)	Prior to milestones or as required	Provide information to the community via media, for example through our regular weekly radio spot and other opportunities
Advertising	Prior to engagement opportunities, as part of the exhibition process	Advertisement providing information on the project and when engagement events and other opportunities will be held
enewsletter	Throughout	Inclusion in MidCoast News Wrap, Creek to Coast, business enewsletter
Social media	As required	• Use social media channels to inform members of the community how they can participate • Monitor responses and use them to inform engagement
Intranet (internal)	As required	• Customer Service briefings • News and updates - all staff
Council Networks	Throughout	• Disability Services • Business Network • Aboriginal Services and Networks • Business Chamber

REPORTING

We will report back to our community on the outcomes of the engagement, making sure we demonstrate that we have listened and reporting on how the input has been used.

The information collected during the engagement process will be used to inform the final project and to develop a report which will be provided to Council's senior executive team and councillors.

The engagement report will also be publicly available on Council's website.

We will also report back to those members of the community who have participated in the process and close the loop by letting participants know how their input has been used to inform the project.

EVALUATION

We will undertake an evaluation of the engagement activities to assist us in gauging whether the engagement program was successful.

This evaluation will also be used when developing upcoming engagement activities.

In evaluating the engagement program, we will report on the following:

1. Number of engagement events/opportunities
2. Number of engagement participants, for example attendees at drop-ins, surveys completed, submissions received
3. Comparisons with benchmarks, for example hits to the Have Your Say page and views of social media posts
4. Satisfaction survey results from events and have your say page
5. Success in attracting a diverse range of participants
   this will be largely anecdotal/subjective).

APPENDICES

Appendix A – Stage 1 Engagement Strategy

Appendix B – Stakeholder Matrix

Appendix C – Southern Estuaries CMP Community Reference Group, Southern Estuaries CMP Technical Working Group and Southern Estuaries CMP MCC Internal Working Group representatives

Appendix D – Engagement “Ideas Bucket”

Appendix A - Stage 1 Engagement Strategy

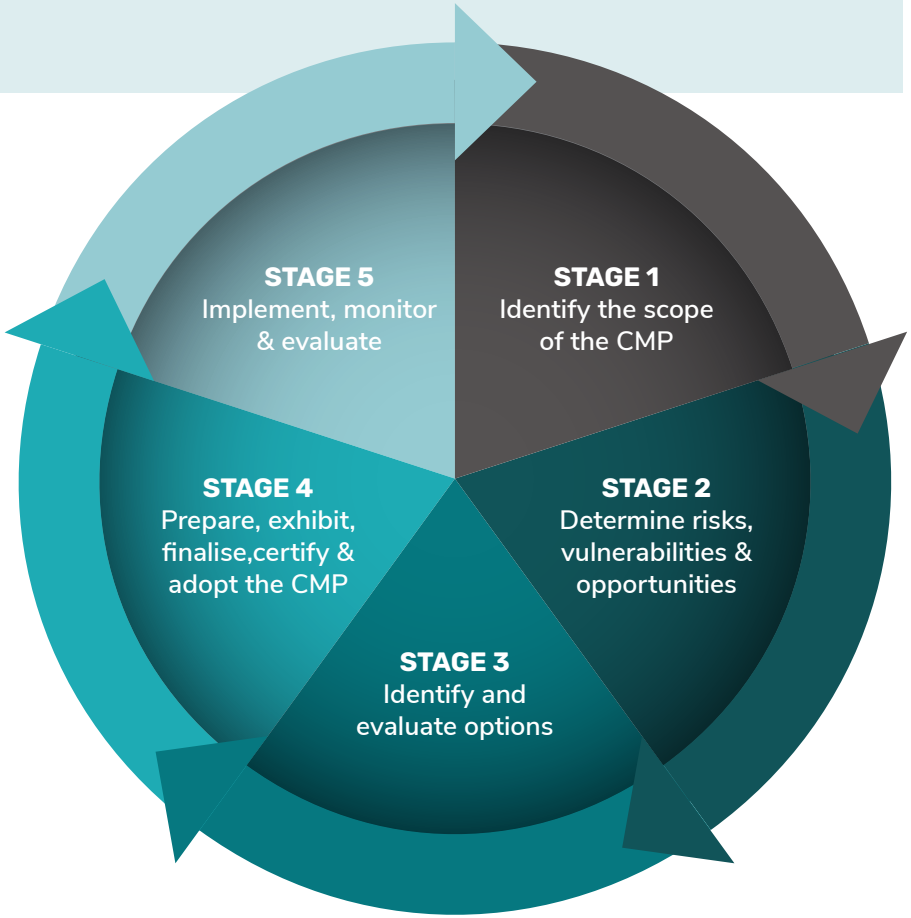
WE BELIEVE THAT HEALTHY CATCHMENTS = HEALTHY ESTUARIES

WE BELIEVE HEALTHY CATCHMENTS AND ESTUARIES = COMMUNITY WELLBEING

The Southern Estuaries of the MidCoast region are one of its greatest assets. They strengthen the MidCoast economy and provide social and recreational values that benefit the people that live, visit and work in the region. The Southern Estuaries Stage One Engagement Strategy is one of the strategic tools that will support and compliment the development and implementation of the Southern Estuaries Coastal Management Program (CMP).

The Coastal Management Program sets out the long-term strategy for the coordinated management of the Southern Estuaries with a focus of fulfilling the objectives of the Coastal Management Act (2016).
The CMP will aid MidCoast Council to identify, understand, prepare for and respond to the uncertainties of a changing coastal estuarine environment.

The CMP comprises a five-stage development process.



The Purpose of Engagement (our WHY)

When we provide people with the opportunity to engage in conversations, to share knowledge and to access nature, we build their motivation and confidence to positively influence the health of their environment. We believe that because communities hold local knowledge, observe 'mother nature', and are able to identify management solutions, they are core to the success of the Southern Estuaries CMP.

Our Southern Estuaries Stage One Engagement Strategy (hereafter referred to as the Engagement Strategy) will enable local communities to participate in the planning, management and prioritisation processes that will help improve land management, community wellbeing, water quality, social and economic value and, ultimately, the ecological health of the estuary.

Objectives of the Engagement

During stage one of the program we wish to draw on local knowledge to understand the social and cultural values of the Southern Estuaries. Identify current and future risks to the Estuaries and ensure that the community has an understanding of estuarine processes. It is also incredibly important that our community participates in the development of management options for our coast.

Engagement Approaches (our HOW)

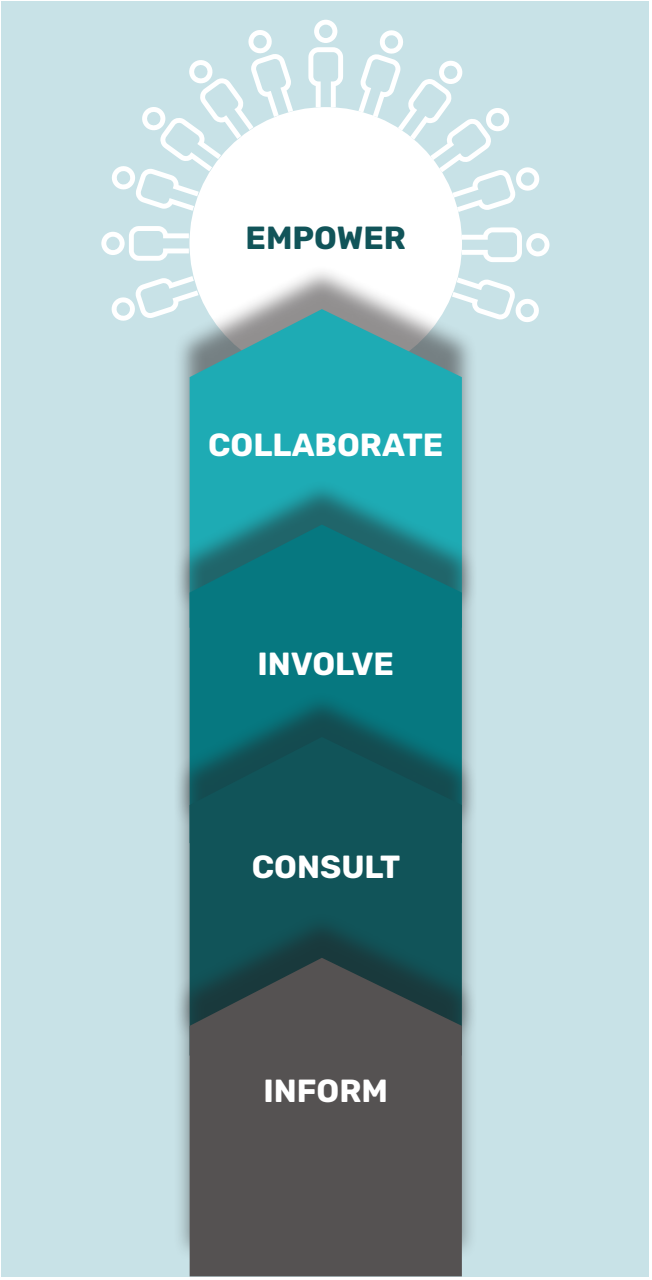
1. Multiple approaches

The community of the Southern Estuaries is diverse and, as such, there is limited value in using a 'one size fits all' engagement approach. We commit to providing people with multiple ways to access and engage with the development of the Stage One Scoping Study for Southern Estuaries ECMP.

2. Levels of Engagement

The proposed levels of engagement during stage one are:

- Inform – Provide the community with balanced and objective information to help them understand estuarine process risks
- Consult – Obtain public feedback on values and risks to the Southern Estuaries.
- Levels of engagement will increase as the CMP process progresses and the community and other stakeholders will be provided with opportunities to Collaborate and Empower in later stages of the CMP.



3. Stakeholders

Stakeholder	Level of engagement
LOCAL LAND SERVICES	Inform/Consult
Department of Planning and Environment	
DPI Fisheries	
DPI Marine Parks	
Transport NSW	
Crown Lands	
University of New South Wales	
University of Newcastle	
National Parks and Wildlife Services	
COMMUNITY	Inform/Consult
Wallis and Smiths Lake Coast and Estuary Group	
Environment Groups	
Council Staff Members	
Forster LALC	
Karuah LALC	

Table 1: List of Stakeholders to be involved in stage one

4. Council is committed

MidCoast Council is committed to genuine engagement and community involvement in the development of the Southern Estuaries CMP. We have listened to the responses in the Community Strategic Plan, as well as to the MidCoast Water Services 'Our Water Our Future' surveys.

Council aspires to be seen as a local knowledge hub, and we want to be viewed by our community as a touch point for hope, optimism and action. To do this, our engagement approach will be accessible, transparent and personal. By integrating our stories about why we are proud to be part of the MidCoast Council we hope to break down any perceived 'us and them' barriers, and inspire the community we are a part of to help sustain the environment, support our economy and provide a range of social and recreational benefits to our local communities.

Throughout the development of the Southern Estuaries CMP we will aim to be effective leaders who empower our community to get involved. We commit to implementing a relevant and meaningful engagement strategy with a clear purpose. Engagement will be undertaken within the MidCoast Council staff to ensure that employees and associated groups are aware of the intention of the Engagement Strategy and are able to be involved.

Implementation framework (our WHAT)

Table 2 integrates the International Association for Public Participation (IAP2) level of engagement, the scale at which the engagement will be delivered, and the types of engagement activities we will undertake.

Level of Engagement	Engagement Scale	What we will do
Inform	Broad	•Establishment of Have Your Say Website •Information Video •Social Media Posts •Media Release •Councillor Bulletin
Consult	Broad Targeted	•Technical Working Group Workshop •Council Working Group Workshop •Wallis and Smiths Lake Coast and Estuary Committee Workshop •Community Survey •CMP Information and Community Survey at upcoming event days •LALC consultation

Table 2: Levels of Engagement Summary.

Broad-scale engagement

The Southern Catchments of the MidCoast Council Region cover approximately 383 575 square kilometres and is home to approximately 40 000 residents meaning our engagement strategy needs to be broad in geographic and demographic scope.

During Stage One the community will be engaged through the establishment of the Have Your Say Website as well through a broadly targeted community survey, social media posts and face to face engagement at community events.

Targeted engagement

The Southern Catchments support a range of people who have a stake in how the resources in the estuaries are managed. Targeted stakeholders will have tailored activities and products to meet their needs, and this way they will be encouraged to have a say.

During stage one our targeted engagement process involves identifying local champions, working with key stakeholders such as Department of Planning and Environment, Local Land Services, Marine Estate Authority, DPI Fisheries, Transport NSW, Landcare, Wallis and Smiths Lake Coast and Estuary Committee and internal Council stakeholders. By seeking advice from these people about how best to engage and capitalise on existing activities we will start the trust building process.

These stakeholders will be engaged through targeted workshops.

In addition, the MidCoast Councillors will be engaged through a Council Workshop and Councillor Bulletins.

How will we know our engagement is successful?

1. Assessing progress

In order to hold ourselves accountable, we must be able to have measurable and achievable objectives. A detailed Engagement work plan will be developed for each stage of the Plan, with Specific Measurable Accurate Relevant Time bound (SMART) objectives, and a timeline for engagement activities. Examples of ways we will monitor and evaluate are identified in Table 3.

2. Reflection

A reflective process is necessary to review and question the position and actions acquired throughout our engagement process. This may be a dedicated time each week, through regular meeting times. Staff must consider what is, and is not, working and why. We believe reflection will enable us to continuously improve our engagement practice and we have inbuilt flexibility so that we can adapt and maximise what is working well. We accept the possibility that community expectations are fluid, and that we need to be able to identify and manage these changing expectations as they arise.

Level of Engagement	Monitoring & Evaluation
Inform	•Activity on Knowledge hub web page •Google analytics •Social media analysis •Stories in local print media
Consult	•Attendance at community events •Community survey responses •Attendance at workshops

Table 3 Monitoring and Evaluating Progress examples.

Conclusion

The Southern Estuaries and Catchments are among MidCoast Council's greatest assets. The stage one Engagement Strategy is one of the strategic tools that will support the development and implementation of the Southern Estuaries Coastal Management Program.

The Engagement Strategy is underpinned by four guiding social principles;

1. **Trust is the foundation for success**
2. **Emotions underpin decision making**
3. **Place and culture are intertwined**
4. **Social and natural capital are linked.**

We are committed to enabling our local communities to improve land management, community wellbeing, water quality and, ultimately, the ecological, social and economic health of the estuary and feel excited about implementing this engagement strategy.

Appendix B - Stakeholder matrix

The following outlines who we will engage with, their interest in the project, and the level of engagement

Table 7

Stakeholder	Involvement in the project	Level of influence / impact	Level of engagement
COMMUNITY			
Residents	Building knowledge and support is a key objective of the project. Host public workshops on values. On-line survey. Media release, web and social media and update bulletins.	Medium influence Medium impact	Inform, Consult,
Recreational fishers	On-line survey. Media release, web and social media and update bulletins.	Low Influence Low Impact	Inform, Consult
Rural and urban landholders	Building knowledge and support is a key objective of the project. On-line survey. Media release, web and social media and update bulletins.	Low Influence Low Impact	Inform, Consult,
Indigenous community members	Provide briefings to meetings. Host focus groups and provide update bulletins. Notice re draft CMP exhibition.	Medium influence Medium impact	Inform, Consult
Schools and other educational institutions	Share the Science presentations,	Low Influence Low Impact	Inform

Stakeholder	Involvement in the project	Level of influence / impact	Level of engagement
SPECIAL INTEREST GROUPS			
Environmental Interest Groups	Invite reps to nominate for Community Reference Group (CRG). Host focus group workshops, Share-the-Science presentations; project update bulletins. Notice re draft CMP exhibition.	Medium influence Medium impact	Inform, Consult, Involve
Beef, Diary and Oyster Farmers	Invite reps to nominate for Community Reference Group (CRG). Host focus group workshops, Share-the-Science presentations; project update bulletins. Notice re draft CMP exhibition.	Medium influence Medium impact	Inform, Consult, Involve
Recreation Clubs	Provide briefings to meetings. Host focus groups and provide update bulletins. Notice re draft CMP exhibition.	Low Influence Low Impact	Inform, Consult
Business & Tourism networks	Provide briefings to meetings. Host focus groups and provide update bulletins. Notice re draft CMP exhibition.	Low Influence Low Impact	Inform, Consult
MidCoast 2 Tops Landcare network	Host focus group workshops, Share-the-Science presentations; project update bulletins. Notice re draft CMP exhibition.	Medium influence Medium impact	Inform, consult, involve, Collaborate
Karuah Great Lakes Landcare network	Invite reps to nominate for Community Reference Group (CRG). Host focus group workshops, Share-the-Science presentations; project update bulletins. Notice re draft CMP exhibition.	Medium influence Medium impact	Inform, consult, involve, Collaborate

Stakeholder	Involvement in the project	Level of influence / impact	Level of engagement
KEY STAKEHOLDERS			
Councillors	Councillor briefings, consultation workshops, bulletins & reports.	High Influence High Impact	Inform, Consult, Collaborate
EMANEX/MANEX	CMP briefings, consultation workshops, bulletins & reports.	High Influence High Impact	Inform, Consult
MCC Staff	Participation in Internal Working Group, Sign-off on draft CMP actions relating to their agency.	High Influence High Impact	Collaborate
Port Stephens Council	Participation in workshops, notification of CMP on public exhibition	Medium Influence Medium Impact	Consult
Department of Planning and Environment (Science Unit)	Participation in the Technical Working Group, Share the Science Presentations, Sign-off on draft CMP actions relating to their agency.	High Influence High Impact	Collaborate
Department of Planning and Environment (Water, Floodplains and Coast)	Participation in the Technical Working Group, Share the Science Presentations, Sign-off on draft CMP actions relating to their agency.	High Influence High Impact	Collaborate
Internal Working Group	Consultation workshops, bulletins, preparation of management actions.	High Influence High Impact	Collaborate
Technical Working Group	Consultation workshops, bulletins, risk analysis, preparation of management actions.	High Influence High Impact	Inform, Consult, Involve
Reference Group	Consultation workshops, bulletins, briefings, risk analysis, preparation of management actions.	High Influence High Impact	Inform, Consult, Involve
Local Aboriginal Land Councils	Consultation workshops, bulletins, briefings, risk analysis, preparation of management actions.	High Influence High Impact	Inform, Consult
Emergency Services	Sign-off on draft CMP actions relating to their agency.	Low Influence Low Impact	Inform

Stakeholder	Involvement in the project	Level of influence / impact	Level of engagement
DELIVERY PARTNERS			
National Parks and Wildlife Service	Participation in the Technical Working Group, Share the Science Presentations, Sign-off on draft CMP actions relating to their agency.	High Influence High Impact	Collaborate
Forests NSW	Participation in the Technical Working Group, Sign-off on draft CMP actions relating to their agency.	Medium Influence Medium Impact	Consult
Office of Water	Participation in the Technical Working Group, Sign-off on draft CMP actions relating to their agency.	High Influence High Impact	Collaborate
Department of Primary Industries – Fisheries	Participation in the Technical Working Group, Sign-off on draft CMP actions relating to their agency.	High Influence Medium Impact	Collaborate
Department of Primary Industries – Marine Parks	Participation in the Technical Working Group, Sign-off on draft CMP actions relating to their agency.	High Influence Medium Impact	Collaborate
Hunter Local Land Services	Participation in the Technical Working Group, Share the Science Presentations, Sign-off on draft CMP actions relating to their agency.	High Influence High Impact	Collaborate
Transport NSW	Participation in the Technical Working Group, Represent recreational boating interests	High Influence Low Impact	Collaborate
Indigenous Service Providers	CMP briefings, consultation workshops, bulletins & reports.	Low Influence Low Impact	Inform, Collaborate

Appendix C

Southern Estuaries CMP Community Reference Group, Southern Estuaries CMP Technical Working Group and Southern Estuaries CMP MCC Internal Working Group representatives

Southern Estuaries CMP Community Reference Group:

- Councillors
- Key public authorities who represent the major public land or asset owners within this CMP area who have the expertise, ability and responsibility to influence the management of the Southern Estuaries
- Traditional owners within the project area
- Oyster Industry
- Professional fishing industry
- Rural industry (eg Dairy/ Beef/ Horticulture)
- Boating or recreational fishing interest
- General community members within the project area
- Landcare
- Staff representatives from Council

Southern Estuaries CMP Technical Working Group

- Hunter Local Land Services
- National Parks and Wildlife Service
- Department of Environment
- DPI – Marine Parks
- Department of Planning and Environment (Crown Lands)
- Forests NSW
- DPI – Fisheries
- Transport NSW

Appendix D

To complement the engagement methodology in this strategy an “Engagement Ideas Bucket” has been prepared to allow engagement to evolve as we work with our local community on the development of the Southern Estuaries CMP. These engagement ideas could be employed during stages 2-4 of the process to enhance the engagement ideas identified in tables (?? To ??), as well as during stage 5 implementation of the program to empower our community. Engagement ideas have been separated into two ‘streams’, broad-scale and targeted to enable us to reach as many members of the community as possible.

Type of engagement	Broadscale	Targeted
Catchment stories through an online presence	•	
Iconic species reflecting estuary connection	•	•
Historical photos as windows through time	•	
Idea of custodianship e.g. ‘Our Southern Estuaries’	•	
Connection to Country – Aboriginal history, traditional ecological knowledge, totemic species significance to the estuary and aspirations for the Southern Estuaries	•	•
Infographics linking issues of concern with action	•	
Postcards highlighting different values/feelings/quotes from people in the stage 1 survey		•
Share the Science events to provide technical expertise and how the CMP can be used to address problems and build on opportunities	•	•
Use of World and National event days to promote the CMP	•	•
History of the Southern Estuaries reflecting interdependence of people and nature	•	
Plan and promote a Southern Estuaries art and or photography exhibition	•	
Quotes and images used on social media to instil pride	•	
Leverage off/value add what is already happening in the catchment so our messages build on wider community interest and activity	•	•

Table 8

Type of engagement	Broadscale	Targeted
Establishment of a FAQ page	•	
Information signage on estuary issues placed around the Southern Estuaries		•
Involving the community in workshops using multicriteria analysis to inform risk assessment issues and CMP actions		•
Which catchment do you live in publications and online resources		•
Estuary processes expert talks		•
Community involvement in ecological health data collection / environment audit		•
Kayaking clean ups/ Paddle with an expert		•
Fish project/ day with DPI expert		•
Biodiversity Celebration Day and BioBlitz	•	•
Attendance at Community led event days such as Envirofair		•
Knowledge audits through conversation and target questioning		•
One on one site visits and interviews – pragmatic optimism questioning to understand values and develop a vision. In “What do you love about living in the Southern Estuaries community? “What are your aspirations?” “What do we need to know to refine our aspirations?” “What do we need to do to recognise our aspirations?”		•

MIDCOAST
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An analysis of the key community groups in the study area was also conducted using the Community Directory on the website of MidCoast Council, other online resources, and discussions with Council. The key community and special interest groups are included in Table A 1, noting some groups may also fall under “Special Interest Groups” as described in Section 5.2.2.

Table A 1 Key Community and Special Interest Groups in the Study Area

Category	Key community groups
Environment	▪ Dunecare - One Mile Beach and Tuncurry ▪ Manning Valley Landcare ▪ Smiths Lake Foreshore Landcare ▪ Karuah Great Lakes Landcare ▪ Pacific Palms Backyard Bushcare ▪ Sustainable Education Network - Mid North Coast ▪ Myall Koala & Environmental Group Inc – Hawks Nest ▪ National Parks Association Mid North Coast Association ▪ MidCoast Garden Friends

Category	Key community groups
Recreation	▪ Great Lakes Sailing Club ▪ Forster Tuncurry Golf Club ▪ Club Forster Fishing Club ▪ Tea Gardens Country Club/ Fishing Club ▪ Hawks Nest Golf Club ▪ Forster Croquet Club ▪ Pacific Palms Recreation Club/ Fishing Club ▪ Coomba Aquatic Club ▪ Little Street Baths ▪ The Y NSW Tea Gardens ▪ The Y NSW Great Lakes Aquatic and Leisure Centre ▪ The Great Aussie Bush Camp ▪ Sporties Tuncurry ▪ Karuah & District RSL Club ▪ Forster RSL Club ▪ Forster Park Run ▪ Karuah Motor Yacht Club

Category	Key community groups
Emergency services	▪ Marine Rescue NSW - Forster Tuncurry, Port Stephens ▪ NSW SES - Port Stephens Unit ▪ NSW Police - Karuah, Tea Gardens, Bulahdelah, Forster ▪ Fire and Rescue NSW – Forster, Tea Gardens ▪ NSW Rural Fire Service – Tuncurry, Forster, Green Point, Tea Gardens, Karuah ▪ Red Cross - Hawks Nest Tea Gardens, Forster Tuncurry
Community projects	▪ Forster Country Women's Association ▪ Men's Shed - Tea Gardens Hawks Nest, Forster Tuncurry ▪ Lions Club - Forster Tuncurry, Tea Gardens ▪ Rotary Club - Lower MidCoast, Myall Coast
Schools/ educational	▪ University of NSW Smiths Lake Field Station ▪ Great Lakes College Forster Campus ▪ Tea Gardens Public School ▪ Bungwahl Public School ▪ Karuah Public Schools ▪ Pacific Palms Public School ▪ Tuncurry Public School ▪ Holy Name Primary School ▪ Lakes Way Preschool ▪ Tea Gardens Hawks Nest Preschool ▪ Pokey Possum Preschool Forster ▪ Pebbly Beach Early Learning Centre Little Beaver Pre School ▪ Kindilan Early Childhood Centre ▪ Great Lakes Children's Centre ▪ East Coast Child Care ▪ Dolphins Childcare Centre & Cottage ▪ Giggles Early Learning Centre Forster ▪ Little Pioneers Childcare Centre Forster ▪ The Oak Seed Early Learning Centre Forster ▪ Brighter Beginnings Early Learning Centre Tea Gardens ▪ Seashell Early Learning Centre Smiths Lake ▪ Annabelle's Long Day Care Centre Charlotte Bay

Category	Key community groups
Business & Industry	▪ Forster Tuncurry Business Chamber ▪ Myall Coast Chamber of Commerce & Tourism ▪ Karuah Chamber of Commerce ▪ Destination Barrington Coast ▪ NSW Farmers ▪ NSW Shellfish Committee
Resident/ progress associations	▪ Green Point Community Association ▪ Bungwahl and District Progress Association ▪ Karuah Progress Association ▪ Forster Neighbourhood Centre ▪ West River Residents Association ▪ Pindimar Bundabah Community Association ▪ North Arm Cove Residents Association ▪ Hawks Nest Tea Gardens Progress Association

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APPENDIX B
OVERVIEW OF EXISTING INFORMATION

TABLE B-1 Existing Studies and Plans

Ref#	Document	Date	Author
Coastal & Estaury Management Plans & Studies			
1.01	Manning River Estuary & Catchment Scoping study.	2021	MIdCoast Council
1.02	Smiths Lake Coastal Zone Management Plan	2018	BMT WBM.
1.03	Coastal Zone Management Plan for Smiths Lake Estaury- review and update	2018	BMT WBM.
1.04	Karuah River Catchment Management Plan	2015	Great Lakes Council
1.05	Wallis Lake Estuary and Catchment Management Plan	2014	Great Lakes Council
1.06	Port Stephens Foreshore Management Plan.	2009	Umwelt
1.07	Wallis Lake Estuary Management Plan	2005	Great Lakes Council
1.08	Wallis Lake Catchment Management Plan	2003	Great Lakes Council
1.09	Smiths Lake Estuary Management Plan	2001	Great Lakes Council
1.1	Port Stephens and Myall Lakes Estuary Management Plan.	2000	Umwelt
Floodplain Management Plans & Studies			
2.01	Karuah River and Stroud Flood Study Update	2021	Advisian
2.02	Draft Port Stephens Foreshore(Floodplain) Risk Manangement Study and Plan Review.	2020	BMT WBM.
2.03	Khappinghat National Park, Khappinghat Nature Reserve and Saltwater National Park Plan of Management	2019	NPSW
2.04	North Arm Cove Stormwater Management Stratergy.	2017	BMT WBM.
2.05	Sediment and Hydrodynamic Assessment of the Lower Myall River Estuary and Preparation of Management Recommendations.	2017	BMT WBM.
2.06	Lower Myall River and Myall Lakes Flood Study	2015	BMT WBM.
2.07	Wallis Lake Foreshore (Floodplain) Risk Management Study: Flood Study Review.	2014	WMAwater
2.08	Pindimar, Lower and Upper Pindimar, and Bundabah Foreshore Erosion Study	2010	BMT WBM.
2.09	Karuah River Flood Study	2010	Great Lakes Council
2.1	Port Stephens Design Flood Levels - Climate Change Review.	2010	WMAwater
2.11	Smiths Lake Flood Study.	2008	Webb, McKeown & Associates.
2.12	Black Head Lagoon Entrance Managemnt Plan (Draft)	2006	Greater Taree City Council
2.13	Myall Lakes National Park and Myall Coast Reserves Plan of Management.	2002	NPSW
2.14	Port Stephens Foreshore (Floodplain) Management Plan, prepared for the Port Stephens and Great Lakes Councils.	2002	WMAwater

2.15	Smiths Lake Estuary Process Study	1998	Webb, McKeown & Associates.
2.16	Port Stephens Flood Study- Stage 2 Foreshore Flooding, prepared for the Port Stephens and Great Lakes Councils.	1997	MHL
Relevant Technical Studies and Data			
3.01	Climate change rapidly warms and acidifies Australian estuaries	2020	Scanes et al
3.02	NSW Beach Profile Database	2020	WRL.
3.03	Management of coastal lakes and lagoons in NSW.	2020	Fisheries
3.04	Our Vision.	2020	Waterwatch
3.05	NSW Estuary Tidal Inundation Exposure Assessment	2018	OEH.
3.06	Wallis Lake Seagrass Depth Range Sampling Survey Results.	2017	NSW, OEH
3.07	Swimming in Sand - Frogs and Sand-Mining at Smiths Lake	2017	White et al
3.08	Estuaries and climate change. Technical Monograph prepared for the National Climate Change Adaptation Research Facility.	2016	Glamore et al(WRL)
3.09	Changes in the Global Value of Ecosystem Services	2014	Costanza et al
3.1	Geology of the Lower Hunter Valley	2014	Geological Survey of NSW
3.11	OEH NSW Tidal Plane Analysis 1990-2010	2012	OEH.
3.12	Examining the potential impacts of sea level rise on coastal wetlands in north-eastern NSW, Australia	2011	Akuma et al
3.13	Long Term Trends in NSW Coastal Wave Climate and Derivation of Extreme Design Storms	2011	Shand et al
3.14	Coastal Processes Report: Hydrodynamic and Sediment Transport Assessment of Wallis Lake Dredging.	2011	WorleyParsons
3.15	Ecological Condition of the lower Myall Estuary	2010	DECCW
3.16	Summary of Ecological Information for the Wallis Lake Potential RAMSAR Site	2010	Fiebig et al
3.17	Macrophytes, fishes and invertebrates of Wallis Lake, New South Wales	2010	Glasby et al
3.18	Great Lakes Water Quality Improvement Plan: Wallis, Smiths and Myall. Forster, NSW	2009	Great Lakes Council
3.19	Holocene sea-level change on the southeast coast of Australia: a review	2007	Sloss et al
3.2	Wetland vegetation in the Wallis Lake catchment, lower north coast of New South Wales.	2007	Griffith et al
3.21	Flood-tide delta morphodynamics and management implications, Port Stephens, Australia.	2007	Vila-Concejo et al
3.22	Sea countries of New South Wales: a benefits and threats analysis of Aboriginal people's connections with the marine estate	2007	Everett
3.23	Understanding Blue Green Algae Blooms in Myall Lakes NSW	2004	Dasey, M
3.24	Provenance history of a Carboniferous Gondwana margin forearc basin, New England Fold Belt, eastern Australia: modal and geochemical constraints	1994	Skilbeck et al
3.25	Coastal geomorphology and quaternary geology of the Port Stephens-Myall Lakes area	1992	Thom et al

3.26	Late Quaternary evolution of coastal sand Barriers, Port Stephens-Myall Lakes Area, central New South Wales, Australia.	1981	Thom et al
3.27	Coastal Geology of the Cudgen Area, North Coast of New South Wales	1975	Roy, P.
Local Level Plans, Strategies and Policies			
4.01	Climate Change Strategy Phase 1	2021	MCC
4.02	Biodiversity Framework 2021-2030	2021	MCC
4.03	Waterways and Catchment Report Card	2021	MCC
4.03	MidCoast Rural Strategy: Agriculture and Rural Industries Background Report	2021	MCC
4.04	MidCoast Urban Releases Areas Report	2021	MCC
4.05	Regional Economic Development Strategy	2021	MCC
4.05	Local Strategic Planning Statement	2020	MCC
4.06	Southern Wallis Lake Foreshore Restoration Plan	2020	MCC
4.07	Waste Management Strategy 2030,Reduce, reuse, recycle... re-imagine waste.	2019	MCC
4.07	Waterways and Catchment Report Card	2019	MCC
4.08	Regional Economic Development Strategy 2018-2022	2018	MCC
4.09	Strategic business plan for delivery of water services (Future Directions (2018 - 2048)).	2018	MCC
4.09	MidCoast Destination Management Plan	2017	MCC
4.1	Our Water,Our Future 2045- MidCoast Water's Integrated Water Cycle Management Strategy.	2015	MCC
4.11	Risk Management Quick Process Guide	2003	MCC
Regional Level Plans and Strategies			
5.01	Hunter Local Strategic Plan July 2021 - June 2026.	2021	LSS Hunter Region
5.02	Hunter and Central Coast Enabling Regional Adaptation	2020	DPIE
5.03	Mid Coast Bush Fire Risk Management Plan	2019	MC BRMC
5.04	North Coast Regional Strategic Pest Animal Management Plan 2018 - 2023	2018	LLS North Coast
5.05	Hunter Coast Regional Plan 2036	2016	Department of Planning & Environemnt
5.06	Local Land Services North Coast Local Strategic Plan 2016-2021	2016	LLS North Coast
5.07	Port Stephens Regional Boating Plan 2015	2015	TfNSW
5.08	Great Lakes Regional Boating Plan 2015	2015	TfNSW
5.09	Hunter Rivers Catchment Action Plan 2013-2023	2013	Hunter Rivers CMA
5.1	Port Stephens - Great Lakes Marine Park Operational Plan	2010	MPA
State Level Plans, Strategies and Policies			
6.01	Crown land 2031 – State Strategic Plan for Crown lands	2021	Crown Lands.
6.02	NSW Coastal Dredging Strategy	2019	MIDO

6.03	NSW Marine Estate Threat and Risk Assessment (TARA)	2019	BMT WBM
6.04	NSW Maritime Infrastructure Plan 2019-2024	2019	NSW Government
6.05	Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions	2019	NSW OEH and the EPA
6.06	NSW Marine Estate Management Strategy 2018-2028	2018	Marine Estate Management Authority
6.07	NSW Coastal Management Manual	2018	NSW OEH
6.08	NSW Climate Change Policy Framework	2016	NSW OEH

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APPENDIX C
CZMP AND EMP AUDIT OF IMPLEMENTATION

Wallis Lake Estuary and Catchment Management Plan(Great Lakes Council 2014)						
Code	**Action**	**Lead organisation/ Agency**	**Supporting Organisation**	**Status**	**Learnings and/or Notable outcomes**	**Comments**
WQ1.1	Develop and enact Minibah Aquifer Management Plan	**MCW**	**GLC, NoW**	**Completed**	EMP in place, currently revising.	Need to talk to Water Services
WQ1.2	Implement the new Drinking Water Catchment Clause in the Great Lakes Standard Local Environmental Plan (LEP) as it pertains to groundwater	**GLC**		**Completed**		
WQ1.3	Identify and map groundwater dependent ecosystems and potential impacts due to groundwater extraction, exfiltration and/or pollution	**NoW**	**GLC, MCW**	**Implemented and Ongoing**	Mapped Minimbah, vegetation mapping thats been groundtruthed, groundwater modeling etc all that comply with the state.	
WQ1.4	Investigate the need for a Tuncurry Aquifer Management Plan, particularly in relation to groundwater quality impacting Duck Swamp and the Estuary as well as potential draw down impacting groundwater dependent ecosystems	**GLC**	**NoW**	**Not Commenced / Outstanding**		Small amount of work done on Duck Swamp, but not completed
WQ1.5	Ensure any future or current developments comply with WQIP and do not adversely impact ground water resources and ground water dependent ecosystems through development assessment	**GLC**	**GTCC**	**Implemented and Ongoing**		
WQ1.6	Continue to monitor landfill impacts (Tuncurry and Minimbah) on groundwater as per licence conditions and ensure management of landfill adopts best practice through an EMS	**GLC**		**Implemented and Ongoing**	EMS is in place at both Tuncurry and Minimbah, contractors supply and work under EMS as well. Groundwater monitoring quarterly at Tuncurry, and annually for different factors. Minimbah done quarterly as well (no waste currently).	confirm with Waste
WQ2.1	Work with landholders to build their capacity to undertake sustainable farming activities that improve groundcover and reduce direct cattle impacts on waterways	**GLC**	**LLS, GTCC**	**Implemented and Ongoing**	Sustainable farming program, engaged with landholders across the Wallis catchment. Landcare education ongoing	
WQ2.2	Review and update existing rural conservation and development strategies	**GLC**	**GTCC, MCW, LLS**	**In progress / Incomplete**	Rural Strategy	Draft completed by strategic planning (MCC wide), awaiting adoption

WQ2.3	Investigate methods to minimise fragmentation and increased land disturbance from rural subdivisions (e.g. reduction in minimum lot size, requirement to fence off a stream if subdividing)	**GLC**		**In progress / Incomplete**	Rural Strategy	This is being considered and progressed in the Rural Strategy and the Consolidated LEP
WQ2.4	Enforce provisions in the Great Lakes Standard Local Environment Plan as they pertain to rural land use	**GLC**		**No Longer Applicable**	Not relevant for future actions	
WQ2.5	Implement Wallis Lake Wetland Strategy (2010), monitor and report on the implementation of this strategy as it pertains to water quality and review and update as necessary	**GLC**		**Implemented and Ongoing**	Wetland acquisition and rehabilitation has been undertaken in Darawank, Minimbah and Failford regions. Investigated the RAMSAR listing for Wallis Lake, report was prepared and application wasn't undertaken due to complexity. Some areas including West Swamp hasn't been acquired.	Wetland Strategy is still relevant and being implemented; the Biodiversity Framework identifies the need for a whole of LGA wetland strategy; but this has not been commenced and is not a short term action in the Framework
WQ2.6	Develop an efficient and effective system for the capture and sharing of new land management practices	**GLC**	**LLS, GTCC**	**No Longer Applicable**		
WQ3.1	Identify and prioritize foreshore areas in need of protection from erosion	**GLC**	**RMS**	**Implemented and Ongoing**	Prioritisation of works undertaken in the Wallamba, not undertaken in other areas.	Could be undertaken in stage two in areas like Pipers Bay, MOU region and otherss using the DPI DST (Decision support tool)
WQ3.2	Develop and implement Best Management Practice for riparian stabilisation in highwash areas according to priority and opportunity	**GLC**	**RMS**	**Implemented and Ongoing**	Stabilisation works have been undertaken at High Priority sites in the Wallamba. Still work to be undertaken in some areas.	
WQ3.3	Continue to implement and periodically review the Wallamba River memorandum of understanding (MoU) regarding the management of powerboat recreational activities	**GLC**	**RMS**	**Implemented and Ongoing**	One review completed, due for another	Due for a review, could perhaps be undertaken in stage two.
WQ3.4	Monitor and assess the impacts and appropriateness of wakeboarding, water-skiingand other powerboat recreational activities in the Wallingat River upstream of the Broadwater and the Coolongolook River	**GLC**	**RMS**	**Not Commenced / Outstanding**	Not generally supported by RMS anymore. Review of the current arrangements in other areas was undertaken approx. 2014	

WQ4.1	Identify and prioritise areas of erosion and sediment input to Wallis Lake from unsealed roads and creek crossings and undertake mitigation activities according to priority	**GLC**	**GTCC, NPWS**	**In progress / Incomplete**	Project by Macquarie University to be reviews. Works being implemented currently through the MEMS program	
WQ4.2	Revise GLC's Erosion and Sediment Control Policy to align with state government standards	**GLC**	**GTCC**	**Not Commenced / Outstanding**		
WQ4.3	Engage internal staff to reduce sedimentation and erosion from GLC projects through the continued implementation of GLC's Sediment and Erosion Control Environmental Management System (SECEMS)	**GLC**	**GTCC**	**Implemented and Ongoing**	Room for improvement, some systems in place. Further works planned and grant applications pending approval.	
WQ4.4	Expand SECEMS to address management of SEC on unsealed roads	**GLC**	**GTCC**	**Not Commenced / Outstanding**	tried through MEMS, but unlikely to gain traction in short term without external pressure	
WQ4.5	Develop a building & construction education program that increases the capacity of architects, designers and builders to implement best practice SEC	**GLC**	**GTCC**	**Not Commenced / Outstanding**	Room for improvement, some systems in place. Further works planned and grant applications pending approval.	
WQ4.6	Include driveway specifications for SEC and sealing in high-risk locations in the requirements for Development Applications in rural and rural-residential areas	**GLC**		**Not Commenced / Outstanding**	Would need to be added to the DCP. Can be difficult in areas where roads aren't sealed to make residents seal	
WQ5.1	Implement the WQIP (2009) as it relates to urban areas	**GLC**	**GTCC**	**Implemented and Ongoing**	Still need to implement Asset management system and WSUD policy for road design guidelines. All other actions ongoing.	
WQ5.2	Develop a WSD education and capacity building program for key urban stakeholders within the community including: developers; building designers and architects; real estate agents; businesses; and residents.	**GLC**		**Implemented and Ongoing**		
WQ5.3	Adopt and implement the Wallis Lake Stormwater Management Plan (Forster- Tuncurry), to improve water quality and overall ecological condition of Wallis Lake	**GLC**		**In progress / Incomplete**	Draft plan, needs to be reviewed and potentially adopted	
WQ5.4	Develop a Stormwater Management Plan for Coomba Park	**GLC**		**Completed**		
WQ5.5	Assess the impacts of excessive sediment build-up at stormwater drains, and remediate if required (for instance Pipers Creek & Bay)	**GLC**		**Not Commenced / Outstanding**	Works done at arlington and dunns creek, DAs have also been assessed and development taking place in the area. Ongoing program to assess stormwater drains on a case by case basis	

WQ5.6	Utilise opportunities in development assessment and land use planning (for instance, rezoning) for the protection of existing drainage lines and stormwater channels to improve the quality of water entering Wallis Lake	**GLC**		**Unknown**	Dunn's?	Check with Gerard
WQ5.7	Protect identified wetlands, foreshore vegetation and remnant long-lived, deep-rooted vegetation in urban areas to maintain water quality	**GLC**		**Implemented and Ongoing**	Ongoing regeneration work on Council Reserves in Forster including, Goldens, Dunn's Creek, Kenrose Street, Southern Parkway and areas in Pacific Palms. Big Island still privately owned.	
WQ5.8	Implement rainwater tank retrofitting program in urban areas	**MCW**	**GLC**	**No Longer Applicable**	Program was run, however stopped in 2016 due to a reduction in numbers of applicants	
WQ5.9	Ensure appropriate development and enforce new provisions in the Great Lakes Standard Local Environment Plan (LEP) 2014 as they pertain to urban land use and foreshore development	**GLC**		**No Longer Applicable**	Ongoing, no longer required as an action	
WQ6.1	Continue to implement the Great Lakes Council Onsite Sewerage Management Strategy	**GLC**		**Implemented and Ongoing**	New OSW plan in progress (MCC wide) to be implemented in 2022	
WQ6.2	Maintain toilet and pump-out facilities on islands in Wallis Lake, adapt to peak usage times and assess need for additional pump out sites	**GLC**		**Implemented and Ongoing**	Ongoing, but we would need a review of the facilities as some have been closed. Removed 2 toilet facilities due to erosion, removal of contents under Dan Aldridge, Peter Caves engineering to have pump outs done, not sure if that has been done. Still probably in need of a pump out. Ones that were approaching capacity were removed.	
WQ6.3	Pursue 1:100 year flood level as benchmark for siting new onsite effluent system disposal areas	**GLC**	**GTCC**	**Completed**	When new DAs are assessed the Septic tank and electrical components must be above 1:100 and land application areas must be above 1:20	
WQ6.4	Ensure all houseboats on Wallis Lake waterways contain greywater holding tanks and negotiate the phase out of houseboats (commercial and private) without greywater holding tanks	**RMS**				Need to talk to RMS

WQ6.5	Continue to educate and engage with boat owners to monitor the effectiveness and efficiency of holding tanks, and minimise potential sewage dumping from vessels utilising or mooring in Wallis Lake	**RMS**	**GLC**			Need to talk to RMS
WQ7.1	Investigate options for the installation of additional gross pollutant traps (GPTs) on urban waterways and ensure appropriate maintenance of existing GPTs	**GLC**	**GTCC**	**Implemented and Ongoing**	Audit of existing systems undertaken, new GPT to be installed at Little street.	
WQ7.2	Run regular clean-ups (involving volunteers, where possible) of waterways and the Lake	**GLC**	**GTCC, LLS**	**Implemented and Ongoing**	Regular cleanups have been undertaken, however there is a need for continued cleanups to be implemented	
WQ7.3	Investigate the effectiveness of targeted Catchment litter management in key sub catchments	**GLC**		**Implemented and Ongoing**	Work undertaken at Pennington Creek. Could be a good action to continue with.	trial in Pipers Creek catchment in 2016(?)
WQ7.4	Ensure adequate receptacles are provided for waste, and that they're emptied and maintained	**GLC**	**GTCC**	**Implemented and Ongoing**	Receptacles in major locations around the lake. Would need to talk to Waste who are currently putting together the tender for the next 10 years and ensure that they are placing adequate ones in the document	
WQ7.5	Engage the general community regarding both the sources of litter and the impacts it has on waterways, native flora and fauna	**GLC**	**GTCC, LLS**	**Implemented and Ongoing**	Continued need for this action. Build new engagement programs	
WQ7.6	Engage commercial and recreational fishers regarding the impacts of fishing debris on the Estuarine and Lake environment	**GLC,**	**DPI (Fisheries), Fishing Co-op**	**Implemented and Ongoing**	LLS working with Oyster growers regarding managing waste on leases	
WQ7.7	Continue to initiate and support campaigns to reduce reliance on plastic bags and other single-use plastics in the community	**GLC**	**GTCC**	**No Longer Applicable**		
WQ7.8	Develop programs targeting engagement of visitors (and local tourism businesses) to the region during peak times to reduce their concentrated impact on waterways	**GLC**	**DPI (Fisheries), LLS**	**Implemented and Ongoing**	Work being undertaken regularly by waste and education team	
EH 1.1	Develop and implement an over-arching Biodiversity Strategy for the Great Lakes LGA. Monitor and report on the implementation of the strategy and coordinate reviews and updates	**GLC**		**Completed**	Biodiversity Framework. Planting strategy	
EH 1.2	Prioritise the development and implementation of specific threatened biodiversity action plans within the Great Lakes LGA, based on an assessment of risk	**GLC**	**GTCC, OEH**	**No Longer Applicable**	Supersecced by Biodiversity Framework which has been completed and adopted	

EH 1.3	Prioritise the protection and improvement of areas deemed as locally significant vegetation or high priority habitat for important biodiversity	**GLC**	**GTCC, LLS, OEH**	**Implemented and Ongoing**	Supersecced by Biodiversity Framework which has been completed and adopted	
EH 1.4	Implement the NSW Threatened Species Priorities Action Statements (PAS) and published recovery plans for threatened species (including federally listed threatened species), populations and ecological communities in the Wallis Lake Catchment. Monitor the outcomes of such activities	**OEH**	**GLC, GTCC, DoE, LLS**	**No Longer Applicable**	Has changed into SOS	
EH 1.5	Continue to promote and provide support to local volunteer environmental groups	**GLC**	**GTCC, LLS, OEH**	**Implemented and Ongoing**		
EH 1.6	Continue to educate and inform the community regarding the importance of biodiversity, including protecting and restoring habitat for threatened species, populations and communities. Engage with the community on the benefits of natural areas	**GLC**	**GTCC, LLS, OEH**	**Implemented and Ongoing**	Landcare, regular event days, communication with general public on projects	
EH 1.7	Adopt and implement a model NRM clause for terrestrial biodiversity in the Great Lakes Local Environmental Plan (LEP)	**GLC**		**In progress / Incomplete**	Being investigated as part of the consolidation of the LEP	
EH 1.8	Pursue collaborations with researchers to design and deliver threatened and important biodiversity research and management programs such as the Forster Local Squirrel Glider Study (Niche Environment and Heritage, 2013). Implement the priority recommendations arising from threatened species investigations and research	**GLC**	**OEH, academic/research institutions**	**Implemented and Ongoing**	Ongoing works on threatened species, particularly the squirrel glider. Not a lot of work with researchers though	
EH 1.9	Collate and update a map of all public and private conservation lands in the Catchment. Ensure permanently protected land (including covenanted lands, development offsets and important habitats identified by the NSW Land and Environment Court) is zoned for Environmental Protection through amendments to Great Lakes LEP 2014	**GLC**	**DP&E**	**Implemented and Ongoing**	Partially complete, some offsets not included. Environmental Protection LEP work being undertaken as part of the consolidation	
EH 2.1	Implement the Tops to Lakes Initiative, monitor and report on outcomes and review and update, as necessary	**GLC**	**GTCC, LLS**	**In progress / Incomplete**	Still recognised in the Bio Framework, however not many onground actions have been completed. A corridor strategy is now to be undertaken as part of the Bio Framework	

EH 2.2	Ensure that native vegetation clearing on private land (including private native forestry) complies with statutory controls and regulations	**OEH**	**OEH, LLS**	**Implemented and Ongoing**		DPE
EH 2.3	Continue to monitor and report regularly on native vegetation cover, fragmentation, public reservation and environmental zoning of catchments across the Great Lakes LGA	**GLC**		**In progress / Incomplete**	Work commenced and scores assigned to most areas of GL. However there is no resourcing for further implementation	
EH 2.4	Continue to promote and support biodiversity and habitat conservation on private land	**GLC**	**GLC, GTCC, LLS**	**Implemented and Ongoing**	Focus of the bio framework	
EH 2.5	Develop and implement a Great Lakes Vegetation Strategy, monitor and report on outcomes. Review and update, as necessary	**GLC**		**No Longer Applicable**	Vegetation management programs are addressed in the adopted MCC Biodiversity Framework	
EH 2.6	Progress the development of a Great Lakes vegetation classification scheme and fine scale, accurate vegetation community mapping. Review and update as necessary	**GLC**	**GTCC, OEH**	**Implemented and Ongoing**	MCC wide focus	
EH 3.1	Install and maintain effective fishways at Dyers Crossing and other crossings according to DPI (Fisheries) identified priorities and opportunities	**DPI (Fisheries)**	**LLS, GLC, GTCC**	**In progress / Incomplete**	Barrier due to landholders not wishing to participate. Other fish passages and crossing being investigated as funding arises	
EH 3.2	Ensure compliance with the Lower North Coast unregulated and alluvial water sources Water Sharing Plan	**NoW**	**Landholders**	**Implemented and Ongoing**	Higher priority under the new department due to drought funding	
EH 3.3	Include water quality, water sharing legislation and environmental flow information in rural landholder extension and education programs	**NoW**	**GLC, GTCC, DPI (Ag), LLS**	**Implemented and Ongoing**		
EH 3.4	Target invasive species which block natural flows in waterways where consistent with agency priorities	**MNCWCC**	**GLC, NPWS**	**Implemented and Ongoing**	Ongoing implementation and management of widespread weeds in drainage and retention ponds, by asset managers. Priority aquatic species managed by the weeds/biosecurity team	
EH 4.1	Continue to work with local landholders to strategically control and reduce weed impacts on farming land and the natural environment	**MNCWCC**	**GLC, LLS, GTCC**	**Implemented and Ongoing**	Ongoing implementation of the weed action program, conducting inspections for priority weed species on private land. Deliver one on one information and advice to assist landholders meet their biosecurity duty.	

EH 4.2	Continue to educate businesses. government agencies and the community regarding the impacts of invasive plant and animal species and their role in control and surveillance	**MNCWCC**	**GLC, NPWS, LLS, GTCC, OEH, DPI (Ag), Forestry, Crown Lands, local landholders**	**Implemented and Ongoing**	Undertake nursery inspections, media and engagement, community event days collaboratively with LLS/Landcare, plantsure	
EH 4.3	Implement the NSW Biosecurity Strategy 2013-2021 and the relevant outcomes of the NSW Strategic Review of Weed Management (2013-14).	**LLS**	**GLC, GTCC, MNCWCC, DPI (Fisheries), Crown Lands, Fishing Co-op**	**Implemented and Ongoing**		
EH 4.4	Work collaboratively with multiple landholders and agencies to establish a prioritised and cross-tenure approach to monitoring and managing terrestrial vertebrate pests within the Catchment (and across the Great Lakes LGA) consistent with state and regional management plans and priorities	**MNCWCC**	**GLC, NPWS, LLS, GTCC, OEH, DPI (Ag), Forestry, Crown Lands, local landholders**	**Implemented and Ongoing**		
EH 4.5	Work collaboratively with multiple landholders and agencies to establish a prioritised and cross-tenure approach to managing invasive weeds within the Catchment (and across the Great Lakes LGA) consistent with state and regional management plans and priorities	**MNCWCC**	**GLC, NPWS, LLS, GTCC, OEH, DPI (Ag), Crown Lands, Forestry, local landholders**	**Implemented and Ongoing**	Inspections undertake, work with networks, LLS DPI and other industry stakeholders	
EH 4.6	Work collaboratively and across tenures to implement the Weeds Action Program and the MNCWCC Regional Weed Management System as it aligns with agency priorities	**MNCWCC**	**GLC, NPWS, LLS, GTCC**	**Implemented and Ongoing**	Active members of the Hunter weed technical team and weeds committee to develop and manage the NSW WAP on behalf of MidCoast Council	
EH 4.7	Prepare and implement specific control action plans for critical outbreaks of high priority weeds and vertebrate pet animals where required	**MNCWCC**	**GLC, NPWS, LLS, GTCC, Forestry**	**Implemented and Ongoing**	Individual plans for priority biosecurity target species	

EH 4.8	Implement relevant actions set out in approved Threat Abatement Plans (TAP) across the Catchment where relevant	**GLC**	**NPWS, LLS, GTCC, OEH, Forestry, mulita agencies, local landholders**	**Implemented and Ongoing**	OS Funding overtook TAP	
EH 5.1	Develop and implement mapping processes to monitor the presence and condition of riparian areas across the Wallis Lake Catchment	**GLC**	**LLS, GTCC**	**Not Commenced / Outstanding**	Some work undertaken by LLS	corridor mapping trialed in Karuah/Myall. Scope to expand to Wallis
EH 5.2	Develop and implement a Riparian Vegetation Management Strategy to prioritise interventions and actions. Complete Foreshore Management Plan for Wallis Lake	**GLC**	**GTCC**	**Implemented and Ongoing**	South Wallis Lake Restoration assessment prepared for Southern of Wallis Lake from Rose Point to Elizabeth Beach and Omaha Bay. Actions currently being implemented, however additional work on enforcement could be improved.	
EH 5.3	Conduct riparian vegetation protection, establishment and rehabilitation works according to priority and opportunity, incorporating works on both public and private land	**GLC**	**GLC, LLS, GTCC**	**Implemented and Ongoing**	Undertaken as funding is available. Some implementation through MEMS, built most rehab projects as well	
EH 5.4	Phase the removal of stock from riparian zones in identified Foreshore Crown Reserves and manage Crown Foreshores for conservation purposes. Zone identified Crown Foreshores for Environmental Protection within the relevant Local Environmental Plans	**Crown Lands**	**GLC, GTCC**	**Unknown**		Ask Crown
EH 5.5	Coordinate and deliver education and awareness programs with regards to the importance of riparian areas	**GLC**	**LLS, GTCC**	**Implemented and Ongoing**	Some work undertaken, often times as part of grant projects and Landcare field days	
EH 5.6	Actively pursue opportunities to research the ecosystem services functions of riparian zones and the best management practice approach to riparian protection and restoration	**GLC**	**LLS, GTCC, Research Institutions**	**In progress / Incomplete**	Not aware of anything in this space. Some work on habitat value of rock fillets, awaiting report	
EH 6.1	Continue with seagrass surveys on a regular basis	**GLC**	**DPI (fisheries)**	**Implemented and Ongoing**	Undertaken each year as part of Report Card monitoring in Wallis Lake	
EH 6.2	Promote the importance of seagrass and other aquatic habitats, and their protection to stakeholders and the general community	**GLC**	**DPI (fisheries)**	**Implemented and Ongoing**	Ongoing education through Report Card, event days, fact sheets etc.	

EH 6.3	Promote appropriate behaviours to minimise impacts on seagrass beds, including promotion of seagrass friendly moorings	**RMS**	**DPI (fisheries)**	**Implemented and Ongoing**	Engagement through LLS and environmentally friendly mooring	
EH 6.4	Dredge the sand bar encroaching on Posidonia australis beds between Wallis and Tonys Point Islands	**GLC**	**Crown Lands, OEH**	**Not Commenced / Outstanding**	barriers with the distance required to remove the sand. Could become a priority again in the future.	Gerard
EH 6.5	Identify, and where appropriate, establish and promote locations of powerboat exclusion zones in important and sensitive seagrass beds	**RMS**		**Unknown**		
EH 6.6	Actively pursue opportunities to collaborate with researchers on seagrass health and distribution trends in Wallis Lake	**GLC**		**In progress / Incomplete**	Regular monitoring through Report Card. Occasional ongoing research when funding available and university interested.	
EH 6.7	Protect sponge communities by preventing the loss of valuable seagrass and macroalgal habitats	**GLC**		**In progress / Incomplete**	Ongoing monitoring of sponges and community engagement	we are doing research, but are we specifically protecting these areas? Protection is also shared with Crown Lands, fisheries etc. Not just council.
EH 7.1	Map the occurrence and condition of wetlands. Identify priorities for management and action	**GLC**	**LLS**	**Not Commenced / Outstanding**	Some work undertaken, but not completed. Important to be done in Stage Two!	undertaken in Manning, Myall and Karuah - but not Wallis.
EH 7.2	Implement the Wallis Lake Wetlands Strategy, monitor and report on the implementation of this Strategy and review and update as necessary	**GLC**		**Implemented and Ongoing**	Progressively implemented as funding has allowed. As per the Bio Framework an LGA wide wetland strategy needs to be undertaken which will update this strategy. The Wallis Lake Wetland Strategy remains alive and implementation is a focus	. Implementation is occurring, though probably not reporting, etc. Is this still a key council doc, or incorporated into the Bio Framework
EH 7.3	Adopt and implement a model NRM clause for wetlands in the Great Lakes Local Environmental Plan (LEP)	**GLC**		**Not Commenced / Outstanding**	Being considered through the new consolidated plan	
EH 7.4	Continue to rehabilitate purchased wetlands and investigate and pursue further strategic purchases of wetlands	**GLC**		**Implemented and Ongoing**	Ongoing Reveg and restoration works regularly undertaken on all purchased properties. Still investigating opportunities for future land purchase	

EH 7.5	Continue to educate and engage the community regarding general and local wetland values and issues	**GLC**	**GTCC, NPWS, LLS**	**Implemented and Ongoing**	Ongoing event days and promotion of wetland issues	
EH 7.6	Focus on wetland protection, restoration and management on private lands	**GLC**	**LLS**	**Implemented and Ongoing**	MEMS and LLS Support	
EH 7.7	Protect natural wetlands from grazing pressures	**GLC**	**GTCC, LLS**	**Implemented and Ongoing**	Focus for LLS and Landcare	
EH 7.8	Pursue collaborations with researchers to design and deliver wetland condition assessment and reporting	**GLC**		**Not Commenced / Outstanding**	Potential in Stage Two as part of the Wetland mapping	
EH 8.1	Continue to investigate threats posed to different landscapes and ecosystems by climate change and sea level rise, as well as mitigation and adaptation options for all land managers	**GLC**	**LLS, NPWS, OEH, GTCC**	**In progress / Incomplete**	Stage Two	
EH 8.2	Prioritise the adaptive management of areas and ecosystems most at threat from climate change and sea level rise	**OEH**	**LLS, GLC, GTCC, Crown Lands**	**Unknown**	Could be investigated through Wetland assessments in Stage Two	
EH 8.3	Continue to monitor the condition and extent of saltmarsh around Wallis Lake	**GLC**	**DPI (fisheries)**	**In progress / Incomplete**	Base mapping undertaken, however no monitoring has been undertaken since. May be some research from other partners	
EH 8.4	Investigate opportunities to purchase or otherwise protect suitable areas to act as buffer zones to allow for ecosystem migration based on predicted sea level rise impacts on Wallis Lake and Estuaries	**GLC**	**OEH**	**Not Commenced / Outstanding**	Should be part of the conversation moving forward	
EH 8.5	Implement appropriate management actions from: Condition Assessment and Management Considerations for Saltmarsh in Wallis Lake (Umwelt, 2012) and any subsequent reports	**GLC**	**OEH**	**Not Commenced / Outstanding**		
CW1.1	Ensure commercial fishers continue to comply with the Fishery Management Strategy for the Estuary General Fishery and that the Code of Practice is readily available to fishers	**DPI (Fisheries)**	**Fishing Co-op**	**Unknown**	Discussions with the Co-op indicate that they don't know about this action which may indicate that he code of practice is not readily available to fishers (however I don't know if it is a code of practice for professional or recreational fishing).	

CW1.2	Implement the Environmental Management System for Wallis Lake Estuary – General Fishery, and review/update as opportunity allows	**Fishing Co-op**	**DPI (Fisheries)**	**Implemented and Ongoing**	It was noted by the Coop that this would likely be needing to be reviewed and also that it was this EMS was what helped them keep their fish in Woolworths following a review by WWF about the purchase of sustainable fishing	
CW1.3	Promote the DPI (Fisheries) Responsible Fishing Guidelines and the Wallis Lake District Recreational Fishing Guide, and support the application of the National Code of Practice for Recreational & Sport Fishing (2001) to local recreational fishers.	**DPI (Fisheries)**		**Unknown**		Kylie Russell
CW1.4	Investigate options for the monitoring of recreational fishing catch	**DPI (Fisheries)**		**Unknown**		Kylie Russell
CW1.5	Support a broad communication and education program addressing sustainable management of the Wallis Lake fishery.	**Fishing Co-op**	**DPI (Fisheries), GLC**	**Implemented and Ongoing**	This action is being implemented by the Co-op and could be considered as an ongoing action. This is achieved through conversations with customers, tour groups, face book promotions. In the past the coop have undertaken surveys about the services they provide and feedback has been positive, the community and visitors really appreciate having a Coop and being able to buy local fish.	
CW1.6	Implement the National Climate Change Action Plan for Fisheries and Aquaculture and review and update as necessary.	**DPI (Fisheries)**	**Fishing Co-op, Oyster Industry**	**Unknown**	Conversations with the co-op indicate that they don't know about this action plan, it may be more relevant to the oyster industry. Follow up with DPI	Kylie Russell
CW1.7	Continue to support the implementation of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS)	**Oyster Industry**	**DPI (Fisheries), WLSQAP, GLC**	**No Longer Applicable**		
CW1.8	Undertake a collaborative effort to audit and manage land-based oyster industry infrastructure to ensure environmental conditions of leases are being met.	**Crown Lands**	**Fishing Co-op, DPI (Fisheries)**	**Unknown**		Kylie Russell

CW2.1	Where activities are being proposed or undertaken—identify, monitor and protect sites of known significant Aboriginal and European heritage, and where there is uncertainty about the value of culture and heritage, a precautionary approach is adopted.	**GLC**	**GTCC, NPWS, Crown Lands, LLS, FLALC**	**No Longer Applicable**	MCC policy in place, REF process and AHIPs undertaken when necessary	Aboriginal heritage components of REF
CW2.2	Incorporate information regarding local Aboriginal cultural history and connection to land in educational material for the community and visitors	**GLC**	**GTCC, NPWS, LLS, FLALC**	**Implemented and Ongoing**	Try to implement as often as possible	
CW2.3	Continue to implement the ongoing strategies of the Indigenous Fisheries Strategy and Implementation Plan	**DPI (Fisheries)**	**FLALC**	**Unknown**		Kylie Russell
CW2.4	Develop site-specific foreshore management plans for Pacific Palms, Pipers Bay, Little Street foreshore and Tuncurry, and ensure appropriate and sensitive foreshore development through land use planning tools	**GLC**	**Crown Lands, OEH**	**Not Commenced / Outstanding**	No specific management plans prepared, however planning tools and other development assessment and AHIP assessment tools are utilised on a project basis	
CW2.5	Seek funding to develop the Forster Keys/Little St walkway	**GLC**		**Implemented and Ongoing**	Currently awaiting AHIP approval for little street section of the project to be able to be implemented. Would be a good one for the next plan. Chat to Brock about the future	Applied for funding in approximately 2019 - unsuccessful
CW3.1	Allocate, promote and monitor management areas, speed restriction zones, powerboat and jet ski-restricted zones in Wallis Lake and tributaries	**RMS**		**Unknown**		
CW3.2	Promote and provide information about the importance of safe and sustainable waterway use	**RMS**		**Unknown**		
CW3.3	Continue to implement Recreational Boating Infrastructure Strategy, and review and update as required	**GLC**	**RMS**	**Implemented and Ongoing**	Revised in 2015, check with Brock	
CW3.4	Implement the Wallis Lake Dredging Maintenance Program in consultation with relevant authorities for navigation channels. Support sustainable dredging of oyster leases in ‘protocol’ area	**GLC**	**RMS, Crown Lands, Oyster Industry**	**Implemented and Ongoing**	Regular dredging undertaken for navigation. Need to update the strategy	
CW3.5	Facilitate appropriate use of islands within the Wallis Lake Estuary and educate the community on the natural and cultural heritage values of the islands	**GLC**	**NPWS, Crown Lands**	**Not Commenced / Outstanding**		

	Smiths Lake Coastal Zone Management Plan(BMT WBM 2018)					
Code	**Action**	**Lead organisation/ Agency**	**Supporting Organisation**	**Status**	**Learnings and/or Notable outcomes**	**Comments**
OP1	Update entrance opening strategy to comply with Marine Parks legislation	**MCC**	**MPA**	**Completed**		
OP2	Formalise approvals/license requirements from DoI (CROWN LANDS DIVISION) for artificial entrance opening, including REF or similar	**MCC**	**DPI (DoI - Crown Lands)**	**Completed**		
OP3	Establish minimum floor level for developments as defined by the flood level in the Floodplain Risk Management Plan (FRMP)			**Completed**	Some older properties in the flood area.	
OP4	Undertake Floodplain Risk Management Study and Plan, incorporating climate change projections	**MCC**	**OEH**	**Completed**	Study undertaken around 2015, data does include future flooding predictions by development and SL rise	
OP5	Undertake a detailed review of the entrance opening strategy and procedure in 2020 and modify strategy as necessary			**Implemented and Ongoing**	Updated the procedure, need to review the strategy.	
OP6	Commence monitoring and recording of entrance conditions and opening impacts	**MCC**		**Completed**	Levels recorded and monitored. Minimal monitoring of impacts	
ES5	Inspect construction sites for compliance with sediment management development controls	**MCC**	**Developers and Land Holders**	**Not Commenced / Outstanding**	No targeted program.	
ES6	Continue works to manage concentrated flows and to rehabilitate eroded gullies, caused by road works in Smiths Lake Village, along the Lakes Way and throughout the catchment	**MCC**	**Bushcare groups**	**Completed**	Has been mostly completed, but there is new hotspots that are being investigated with Engineering for work	
ES10	Survey southern foreshore dune (including wetland edge) near entrance following opening events	**MCC**	**OEH (NPWS)**	**Not Commenced / Outstanding**		Area is part of NP, no long term monitoring. Undertaken informally after each opening.
WQ2	Implement strict control of catchment runoff water quality for all development to WQIP Guidelines.	**MCC**		**Implemented and Ongoing**	Built into the DCP and WSUD undertaken for all developments	
WQ4	Repair and maintain all on-site sewage management systems and enforce appropriate action where required	**MCC**	**Land Holders**	**In progress / Incomplete**		OSS program, need feedback from James

WQ6	Classify all on-site sewage systems within 100m of Lake edge as high risk, requiring annual compliance audits	**MCC**		**Not Commenced / Outstanding**	This was not an approach that is being adopted by Council, Council are currently reviewing the approach to OSSM inspections to ensure that high risk sites are inspected. This action is still relevant but needs updating	
HC3	Maintain restricted access to specific areas containing threatened and endangered species e.g. Coastal Spurge plant	**MCC**	**OEH(NPWS)**	**Implemented and Ongoing**		Pedestrian and vehicle barriers installed in areas to exclude or restrict access to sensitive areas
WA2	Develop best practice guidelines regarding cultural heritage management	**MCC**	**Aboriginal Community**	**Implemented and Ongoing**	Established heritage procedure for development. Currently working on an aboriginal cultural plan.	
ES2	Implement best practice design guidelines to reduce sediment erosion during road and infrastructure construction and maintenance	**MCC**	**RTA**	**Completed**		
ES3	Restrict 4WD vehicle access at Wamwarra Bay and enforce compliance	**MCC**	**Vehicle Owners, DoI - Crown Lands**	**Implemented and Ongoing**	Put in place by Marine Parks, new signage, updated education program, videos and fact sheets	
ES7	Investigate success of existing dune stabilisation works and implement maintenance / upgrade program	**MCC**	**OEH, Aboriginal Community**	**Implemented and Ongoing**	Is this to be included in the Coastal CMP rather than Southern Estuaries>	
WQ3	Finalise Draft DCP 34 - Acid Sulfate Soils	**MCC**		**No Longer Applicable**	Being completed in the new DCP	

HC5	Undertake priority pest and weed management in degraded areas e.g. dunes, and incorporate traditional methods of management	**MCC**	**Aboriginal Community, OEH(NPWS)**	**Implemented and Ongoing**	Cultural burning undertaken at Bald Head, future burns being planned. Ongoing pest and weed control on sites around Smiths Lake with contractors. Camera monitoring undertaken of pest species.	
WA3	Limit access for domestic animals around foreshore areas and manage associated waste	**MCC**	**OEH (NPWS)**	**In progress / Incomplete**	Would need full review of dog activity, community engagement etc. Will be doing a review MCC wide in the near future.	
OP8	Investigate and implement options to enhance safety during opening procedure	**MCC**	**NSW Maritime Authority**	**Completed**	Documented in Risk assessment and procedure	
ES1	Review sediment management development controls on building/construction works to comply with best practice and ensure all new driveways in catchment are sealed	**MCC**	**Developers and Land Holders**	**Not Commenced / Outstanding**	Needs a review	
WQ7	Investigate pumping stations at Eagle Nest Parade and Patsy's Flat Rd for leakage / overflows during heavy rains	**MCW**		**Implemented and Ongoing**	Implemented as part of normal business. Not a targeted program. Talk to Tracey about the servicing strategy.	
WQ9	Seal or raise sewer manholes that are currently located below RL 2.5m AHD	**MCW**		**Unknown**		Shane Beeton
WQ10	Investigate possible pollutant point sources into the Lake and creeks	**MCC**	**Community**	**No Longer Applicable**	no issues of this nature have been raised in recent years, stormwater pollution is managed via development controls.	

HC2	Implement 'best practice' planning controls for natural buffer zones around the Lake and along major drainage pathways.	**MCC**		**Not Commenced / Outstanding**		Some work is done through the application of the Water Management Act waterfront lands controls, but this has not been delivered as a project
HC9	Investigate fish health within the Lake	**MCC**	**MPA, DPI**	**Completed**		At the time of writing the plan there were fish dying in the lake, professional fishers had them investigated and found out that they had atrophy (researchers suggested that this was from lack of food). There was some suggestions (although anecdotal) that this may have been due to the oversupply of fish in parts of the lake due to professional fishing restrictions and the Marine Park zones.
HC10	Educate the community on existing waterway zoning	**NSW Maritime Authority**	**MPA**	**Implemented and Ongoing**		Limited but some signs and a community event attended
WA5	Increase enforcement of fishing and zoning regulations through increased presence of relevant Compliance Officers and/or Rangers	**NSW Maritime Authority**	**MPA, DPI**			Check with Marine Parks

WQ1	Investigate areas that would benefit from a Stormwater Management Plan and develop and implement where necessary	**MCC**		**Not Commenced / Outstanding**	SW management has been ad hoc, lots of works for improvement have been undertaken. Could be good to keep as an action for the future.	
HC1	Review foreshore zoning during the development of the new Standardized LEP to increase protection for habitat and cultural heritage around the Lake.	**MCC**	**Aboriginal Community, OEH(NPWS)**			
HC4	Investigate options to restrict boating access in the vicinity of seagrass bed areas during low Lake levels	**NSW Maritime Authority**	**DPI**	**Not Commenced / Outstanding**	Not commenced, valid action	
WA1	Liaise with Aboriginal Community regarding developments on or near known or likely Aboriginal heritage sites	**MCC**	**Aboriginal Community**	**Implemented and Ongoing**	Undertaken through DAs, REFs and AHIP applications. Currently working on an aboriginal cultural action plan	
WA4	Identify areas within the Lake entrance area where debris can be removed (for boating safety) and cannot be removed (for habitat protection) and streamline process for removal	**NSW Maritime Authority**	**DPI, OEH (NPWS) & MPA**	**Implemented and Ongoing**	This action was actioned by TfNSW however I cannot remember the outcome PT	
WA8	Encourage the community to utilise existing boat ramps, through education	**MCC**	**NSW Maritime Authority, MPA**	**In progress / Incomplete**	Ongoing issue with locals, some education undertaken at event day but not much progress	
OP7	Develop and implement education program on the dangers and legalities associated with opening events	**MCC**	**NSW Maritime Authority, MPA**	**Completed**	Videos and fact sheets created	
ES4	Sealing of dirt and unsealed roads in Smiths Lake Village e.g. Valley Rd, Phillip Rd, Sandbar Rd	**MCC**	**RTA**	**Completed**	Sandbar Road is private so won't be undertaken. Dogwood Road to be undertaken in 2022	
ES9	Survey Symes Bay for sedimentation / infill	**MCC**		**Not Commenced / Outstanding**		

WQ8	Encourage connection of existing caravan park to reticulated sewerage system, with connection to be specified as a condition of consent for any future redevelopment	**MCW**	**Land Holder**	**Not Commenced / Outstanding**	Conversations have not commenced, highly unlikely that the caravan park would undertake this works unless required to	
HC8	Investigate potential foreshore habitat response to predicted Sea Level Rise	**MCC**	**MPA, OEH(NPWS)**	**Not Commenced / Outstanding**	Valid action, this action could incorporate an assessment of the impacts of opening strategy on fringing vegetation	
WA7	Investigate options to improve boat launching facilities at Brambles Reserve, Tarbuck Bay and John de Bert Reserve	**MCC**	**NSW Maritime Authority, DPI, MPA**	**Not Commenced / Outstanding**		
ES8	Identify eroding watercourses through presence of sedimentation at the outlets of drains and creek around the Lake	**MCC**		**Not Commenced / Outstanding**		Unsure if this is still needed.
WQ11	Develop and implement education program on pollutant sources to Lake	**MCC**	**Community**	**Not Commenced / Outstanding**	There is value in an action like this to manage ESC impacts from development however this is handled by another action.	
HC6	Identify areas of degraded habitat and incorporate into works program for rehabilitation, possibly coordinated with ES6/7	**MCC groups**	**Aboriginal Community, Bushcare**			
HC7	Update mapping and undertake assessment of sensitive habitat areas such as seagrass beds and wetlands	**OEH**	**MPA, DPI**	**Not Commenced / Outstanding**		SEPP maps

HC11	Develop and implement public awareness program on ecological values and important habitat.	**MCC**	**Community**	**In progress / Incomplete**		Some work on the importance of foreshore and lake bed habitats has been completed through videos, posters, report card release. Mainly focussed on education people on how to protect habitats from the impacts of driving on the lake bed. More work on ecological value of the catchment for water quality protection could be done.
HC12	Encourage protection of natural habitat on private land through education and incentives	**MCC**	**HCRCMA, Community**	**In progress / Incomplete**		Some work has been commenced under MEMS and other programs
WA9	Monitor conflicts between users in the Lake	**MCC**	**NSW Maritime Authority, MPA**	**Not Commenced / Outstanding**		It is difficult to know what this action could look like
OP5	Undertake a detailed review of the entrance opening strategy and procedure in 2020 and modify strategy as necessary	**MCC**	**OEH, DPI, MPA**	**In progress / Incomplete**		Procedure was updated (operational) but the whole strategy was not reviewed
WQ5	Maintain and upgrade sewerage system as necessary to accommodate climate change projections e.g. Sea Level Rise	**MCW**		**Not Commenced / Outstanding**		Definitely needs to be built into the CMP

WA6	Investigate the possibility of constructing a foreshore walking track around sections of the Lake	**MCC**	**OEH (NPWS)**	**In progress / Incomplete**		There is a group interested in constructing a track, this is being considered by Council however environmental impacts need to be considered as some unlawful construction has commenced. Discuss where this is at with Liam

Great Lakes Water Quality Improvement Plan: Wallis, Smiths and Myall. Forster, NSW (Great Lakes Council 2009)				
Code	**Action**	**Status**	**Learnings and/or Notable outcomes**	**Comments**
	Wallis Lake	**Implemented and Ongoing**		
	Remedial Actions			
1	Groundcover management	**Implemented and Ongoing**	Being implemented by Landcare groups	3-4 year program of sustainable grazing that assisted in establishing the groups. Haven't monitored the improvements to groundcover
2	Nutrient management (Fertiliser)	**Implemented and Ongoing**		Ongoing projects through Landcare including soil sampling. Also was part of sustainable farming program. Landcare and LLS lead agencies. Poultry work ongoing
3	Infrastructure (Dam) management	**In progress/incomplete**		Ongoing workshops on dam management via Council, LLS and Landcare. No on ground works undertaken
4	Riparian remediation	**Implemented and Ongoing**		Work undertaken in the Wallamba River has been extensive over the last decade
5	Unpaved road remediation	**Implemented and Ongoing**		Some work is being undertaken through the MEMs program including approximately 6 in Wallis. Lakes Way Sugar Creek Rd in Bungwahl has been completed, Seal Rocks rd. completed.
6	Urban Mitigation (Water Sensitive Urban Design)	**Implemented and Ongoing**	Rainwater tank retrofitting program was not continued by Water Services at the time.	Retrofitting WSUD completed, Dunns Creek ongoing, Rainwater tank program to not be moved forward.
7	Water Sensitive Redevelopment	**Implemented and Ongoing**		
	Protection Actions			
8	Wetland protection	**Implemented and Ongoing**		Comments from Wallis, remediation of the Darawank ASS issues have created huge improvements
9	Riparian protection	**Implemented and Ongoing**		Sustainable farming, LLS, Landcare. Monitoring hasn't been undertaken
10	Water Sensitive Development of Greenfield sites	**Completed**		Implemented through the DCP and is ongoing

11	Water Sensitive Urban Design protection	**Implemented and Ongoing**		Undertaken regularly through education days, sustainable gardening program, report card events etc. This could be a program assisted by LandCare in the future. ESC program was undertaken with Council staff and a new program is currently awaiting funding for private works.
12	Best management of unpaved roads	**In progress/incomplete**		Mapping of roads was not undertaken. Some work is being undertaken as part of the MEMS program
13	Improved pollution control systems / management systems	**Not commenced/outstanding**		Some actions were translated into the DPOP but not the majority. Check with Ryan Fenning
14	Improved management of lake use activities	**In progress/incomplete**		SW Plan still in draft, some work with the oyster growers and data collection being undertaken by LLS. Second MOU in the Wallamba was updated in 2014 to cover wakeboarders in the Wallamba. Seagrass bed engagement needs to be continued in the next plan. Boating Plan implemented
15	Foreshore and riparian management in urban areas	**In progress/incomplete**		No set plans, however foreshore management work has been undertaken in different areas around the lake. Riparian management is inconsistent in some of the reserves. An audit of the reserves is currently underway. No real work being undertaken with the community on foreshore management.
16	Protect sea sponge beds	**In progress/incomplete**		Some ongoing sponge research, but no community engagement being undertaken. Questions of jurisdiction of the sponge beds.
	Management Support Actions			
17	Adaptive Management Strategy / Ecological monitoring program	**In progress/incomplete**		2016 catchment report card and ongoing monitoring in annual RC
18	Future investigation relating to the Farm Scale Action Plan	**Not commenced/outstanding**		
	Smiths Lake			
	Remedial Actions			

1	Groundcover management			Drew to comment, can't think of much of this that would be required in the Smiths Catchment is it relevant?
2	Unpaved road remediation	**Implemented and Ongoing**		Outstanding road project is Dogwood road which will be sealed, this will commence next FY
3	Urban Mitigation(Water Sensitive Urban Design)	**Implemented and Ongoing**		No WSUD in existing urban areas was progressed (eg retrofit on Public Land)
	Protection Actions			
4	Water Sensitive Development of Greenfield sites	**Completed**		
5	Best management of unpaved roads			Check with Drew if there has been any in this catchment or if it is even relevant
6	Improved pollution control systems / management systems	**Not commenced/outstanding**		
7	Water Sensitive Redevelopment	**Implemented and Ongoing**		
8	Improved management of lake use activities	**Not commenced/outstanding**		
9	Water Sensitive Urban Design protection	**Not commenced/outstanding**		
10	Water Sensitive Redevelopment	**Implemented and Ongoing**		
11	Foreshore and riparian management in urban areas			Check with Drew and Brock
	Management Support Actions			
12	Adaptive Management Strategy / Ecological monitoring program	**Implemented and Ongoing**		
13	Future investigation relating to the Farm Scale Action Plan	**Implemented and Ongoing**		not very relevant to Smiths Lake
	Myall Lakes			
	Remedial Actions			
1	Groundcover management	**Implemented and Ongoing**		
2	Nutrient management (Fertiliser)			Same as Wallis but also poultry work ongoing
3	Infrastructure (Dam) management	**Implemented and Ongoing**		
4	Riparian remediation	**Implemented and Ongoing**		

5	Unpaved road remediation			National Parks have done a number improvements throughout the Myall
	Protection Actions			
6	Wetland protection	**Implemented and Ongoing**		Acquisition of Bulahdelah Plain Wetlands plus negotiation of protection of additional wetlands on private property. Field days on site.
7	Riparian protection	**Implemented and Ongoing**		Several Myall properties undertaking riparian works as part of the MEMs program. Sustainable farming program. Not as involved as in the Wallis system. Room for improvement.
8	Water Sensitive Development of Greenfield sites	**Implemented and Ongoing**		
9	Water Sensitive Urban Design protection	**Not commenced/outstanding**		Not much work undertaken in the Myall
10	Best management of unpaved roads	**Not commenced/outstanding**		
11	Improved pollution control systems / management systems	**Not commenced/outstanding**		
12	Improved management of lake use activities	**Not commenced/outstanding**		N/A - National Park, Stormwater Plan reviewed.
	Management Support Actions			
13	Adaptive Management Strategy / Ecological monitoring program	**In progress/incomplete**		
14	Future investigation relating to the Farm Scale Action Plan	**Not commenced/outstanding**		Document was developed but no implementation currently. Best Practice work is currently being started

Karuah River Catchment Management Plan (Great Lakes Council 2015)					
Code	Action	Lead organisation / Agency	Supporting Organisation	Status	Comments
1	Map the occurrence and condition of wetlands. Identify priorities for management and action	GLC	LLS	Completed	
2	In collaboration with private landholders, utilize incentives and engagement mechanisms to protect and rehabilitate wetlands within the Karuah River Catchment	GLC	PSC, LLS, DPI (Fisheries), Local Landholders	Implemented and Ongoing	
3	Investigate and pursue the strategic purchases of priority wetlands to improve water quality and biodiversity values	GLC		Not commenced	
4	Continue to engage and inform the community about the value of local wetlands and associated issues	GLC	OEH, LLS, DPI (Fisheries)	Implemented and Ongoing	
5	Investigate the potential for the establishment, re-establishment or enhancement of wetlands in sub-catchments with high nutrient and sediment inputs	LLS	GLC	Not commenced	some of these locations have been identified in The Branch, however these locations haven't yet aligned with interested landholders through protection programs
6	Manage wetlands in the Karuah River Catchment in accordance with the principles and actions of the Wallis Lake Wetland Strategy	GLC		Implemented and Ongoing?	
7	Adopt and implement a model NRM clause for wetlands in the Great Lakes Local Environmental Plan (LEP)	GLC		Not commenced	
8	Improve community knowledge and management of acid sulfate soils in the estuary zone of the catchment	LLS	DPI (Fisheries), GLC	Not commenced	to my knowledge hasn't necessarily been a focus of workshops or education in the area

	9	Conduct works to protect and rehabilitate riparian zones, incorporating the establishment of native vegetation. Works to be carried out opportunistically and in line with priorities. Where possible, develop synergies between works on both public and private land.	**LLS**	**GLC, PSC, DPI (Fisheries), Local Landholders**	**Implemented and Ongoing?**	
	10	Phase out grazing of stock in riparian zones in identified foreshore Crown Reserves and manage Crown Foreshores for conservation purposes. Zone identified Crown Foreshores for Environmental Protection within the relevant Local Environmental Plan	**DPI (Crown Lands)**	**GLC**	**Unknown**	lower Karuah River area (eg Allworth and surrounds)
	11	Map and identify areas at high risk of erosion. Implement an incentive program to prevent and remediate soil erosion within priority areas, including the management of steep slopes	**LLS**	**DPI (SCS), DPI (Fisheries), GLC, DPI (NoW), Local Landholders**	**Unknown**	
	12	Improve community knowledge of the methods available to both prevent and mitigate soil erosion, including the value of riparian vegetation	**LLS**	**DPI (SCS),DPI (Fisheries), GLC**	**Unknown**	
	13	Identify and prioritise areas of sediment export to the Karuah River from unsealed roads, tracks and creek crossings and undertake mitigation activities according to priorities	**NPWS**	**Forestry Corporation, GLC, PSC, Local Landholders**	**Implemented and Ongoing**	
	14	Expand GLC Sediment and Erosion Control Environmental Management System (SECEMS) to address management of sediment and erosion control of Council managed unsealed roads	**GLC**		**Not commenced**	discussed initial training with Operations team during MEMS Stage 1 rollout, and while there was interest (quotes sought), no final commitment from Operations team due to current high workload from rains, flood, covid and fed/state investment in road upgrades

15	Assess road network needs for operational and fire management purposes. Close and rehabilitate roads surplus to requirements and install locked gates as appropriate to minimise erosion from recreational vehicles	**Forestry Corporation**	**NPWS**	**Unknown**	
16	Ensure future developments comply with GLC's Water Quality Objectives to: (a) ensure re-development and infield developments achieve a load reduction, and (b) all greenfield developments achieve a neutral or beneficial effect on water quality	**GLC**		**Implemented and Ongoing**	addressed through Chapter 11 of DCP
17	Review and update the Karuah section of the Port Stephens Urban Stormwater and Rural Water Quality Management Plan.	**PSC**		**Unknown**	
18	Ensure all future developments in the Karuah area address the objectives of the Port Stephens Urban Stormwater and Rural Water Quality Management Plan	**PSC**		**Unknown**	
19	Develop a stormwater management plan for Stroud	**GLC**		**No longer Applicable**	
20	Continue to implement the Great Lakes Council Onsite Sewerage Management Strategy, including the following recommendations: • all systems are inspected to determine if they are operating satisfactorily • inspect more frequently systems identified as high-risk or that are operating poorly • pump-out records are monitored to ensure systems are not overflowing or being illegally emptied • aerated Wastewater Treatment System (AWTS) reports are monitored to ensure owners are aware of maintenance that is required • approval and ongoing monitoring of AWTS contractors to ensure qualified technicians are carrying out quality services.	**GLC**		**Implemented and Ongoing**	
21	Continue to initiate and support campaigns to reduce the reliance on plastic bags and other single-use plastics in the community that contribute to roadside litter and rural rubbish	**GLC**		**Not commenced**	
22	Ensure compliance with the Karuah River Water Sharing Plan	**DPI (NoW)**		**Implemented and Ongoing**	
23	Include water quality, water sharing legislation and environmental flow information in rural landholder extension and education programs	**DPI (NoW)**	**GLC, DPI (Ag), LLS**	**Unknown**	
24	Investigate the current status of groundwater quality and quantity; develop and implement programs to mitigate any significant impacts	**OEH**	**DPI (NoW), Miners and other large users of groundwater**	**Unknown**	note recent comments from DPI re Ground water in Karuah Water sharing plan

25	Implement the Groundwater and Drinking Water Catchment Clause in the Great Lakes Standard Local Environment Plan (LEP)	**GLC**	**MCW**	**In progress**	7.6 in Great Lakes LEP Drinking water catchment clause proposed through MCC Rural Strategy.
26	Ensure that any future or current developments comply with the Great Lakes WQIP and do not adversely impact groundwater resources and ground water dependent ecosystems through development assessments	**GLC**	**PSC**	**Implemented and Ongoing**	
27	Investigate nutrient and sediment loads in order to identify 'nutrient and sediment hotspots' within the catchment. Use this information to determine priority areas for action and, in particular, assess nutrient and sediment source 'hotspots' during storm events	**OEH**	**GLC, Research Institutions**	**Implemented and Ongoing**	Report Card 2016
28	Within GLC's Waterway and Catchment Report Card, undertake for the Karuah River Catchment: (a) water quality monitoring every two years, and (b) a catchment wide assessment of riparian and instream aquatic health, including seagrass, saltmarsh and mangrove habitat every five years. Investigate and pursue collaborations and potential partnership opportunities for completing the Report Card and riparian and instream aquatic health assessment	**GLC**	**OEH, Duralie Coal, Forestry Corporation, NPWS, MCW, DPI (NoW), DPI (Fisheries), Research Institutions**	**In progress**	The Branch River now part of annual report card (previously every second year). 2016 was last catchment-wide assessment
29	In collaboration with landholders build understanding and capacity to increase the adoption of best management practices which address catchment degradation and encourage profitable farms. Opportunities for focused action may include focus farms, group mentoring programs, on farm trials, farm sector advisory groups, demonstration sites, landholder champion programs, and property management planning activities	**LLS**	**DPI (Ag), DPI (Fisheries), GLC, KGLL, Local Landholders**	**Implemented and Ongoing**	
30	Targeting sediment and nutrient hotspots, work in collaboration with landholders to improve grazing/groundcover management, soil health (including organic carbon) and water use efficiency	**LLS**	**DPI (Ag), DPI (Fisheries), GLC, KGLL, Local Landholders**	**Implemented and Ongoing**	LLS are a partner in the Beyond the Shed program focusing on intensive poultry farmers

31	In collaboration with the poultry industry explore and implement appropriate options for improved management of poultry litter throughout the whole poultry litter supply chain e.g. Fertcare	**DPI (Ag)**	**NSW Farmers Association, LLS, GLC, Local Landholders**	**In progress**	Fertcare hasn't specifically been applied, but a program of soil testing and nutrient mapping for intensive poultry farms is being rolled out in the district
32	Expand and implement a best practice fertiliser storage and application program, targeting hotspots of nutrient loss within the catchment	**LLS**	**DPI (Ag), GLC, Local Landholders**	**Implemented and Ongoing**	Beyond the Shed program developed between MCC and LLS targeting grazing paddocks of intensive poultry farmers.
33	Support the development of business plans and environmental management systems within the oyster industry	**LLS**	**DPI (Fisheries), DPI (Food Authority), GLC, PSC, Oyster Industry**	**Not commenced**	
34	Encourage the sharing of knowledge and understanding between oyster growers, other primary producers and other users of the catchment's land and water resources	**LLS**	**DPI (Fisheries), DPI (Food Authority), GLC, PSC, KGLL, Local Landholders, Oyster Industry**	**Implemented and Ongoing**	
35	Continue to support the implementation of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS)	**Oyster Industry**	**DPI (Fisheries), DPI (Food Authority), GLC, PSC**	**Unknown**	
36	In recognition of the high quality and sensitive catchment values, encourage new or existing large-scale extractive industry to achieve a beneficial effect on catchment health through: • contributing to the Karuah Catchment improvement fund • contributing to improved understanding of catchment functioning and health • adopting best practice catchment management procedures on mine owned land.	**GLC**	**LLS, Extractive Industry, MCW**	**In progress**	ongoing liaison with Duralie (Yancoal) Coal regarding Karuah Catchment Improvement fund. Ongoing involvement and presentations to Duralie Community Consultative Committee

37	In collaboration with the poultry industry, review and update the development control requirements for new poultry sheds taking into consideration: • the export of nutrients • odour and visual impacts • land use buffering to reduce conflict with neighbouring landuses • potential adverse effects to farm biosecurity.	**GLC**	**NSW FA, Poultry Farmers, Research Institutions**	**In progress / no longer applicable**	Focus has shifted to nutrient mapping of grazing paddocks. Targeted project focusing on development controls associated with onsite composting of daily mortalities
38	In collaboration with the poultry industry investigate and implement incentive mechanisms for voluntarily retrofitting of existing poultry farms to achieve best practice. Potential improvements could include: • practices to reduce the export of nutrients • wetland systems • riparian buffers • waste disposal • landscaping and screening practices • odour management.	**GLC**	**NSW FA, Poultry Farmers, LLS, DPI (Ag), Research Institutions**	**Implemented and Ongoing**	
39	Enforce provisions in the Great Lakes Standard Local Environment Plan as they pertain to rural land use.	**GLC**		**Implemented and Ongoing**	
40	Evaluate the merits of preparing and implementing an Agriculture Strategy for the Karuah River Catchment	**GLC**		**No longer Applicable**	
41	Research the long-term impacts of regular applications of chicken litter on pastures in high rainfall areas and their influence on soil condition	**Research Institutions**		**In progress**	ongoing liaison with DPI regarding impacts of high levels of P in soil and how this can be managed. Regular contact with UNE and Australian Eggs.
42	Continue catchment management education programs, such as Water Watch, with local primary schools and community groups	**LLS**	**GLC, Community**	**Implemented and Ongoing**	
43	Continue to use communication and social marketing tools such as newsletters, extension, field days and websites to promote an understanding and awareness of catchment management within the community	**LLS,**	**DPI (Ag),DPI (NoW), DPI (Fisheries), GLC, KGLL, MCW**	**Implemented and Ongoing**	

44	Explore and implement opportunities to build the capacity of rural lifestyle and absentee landholders to protect, maintain and restore catchment health. Opportunities could include: • the introduction of mentoring programs, the promotion of local champions and the development of focus groups • development of NRM information packages for rural lifestyle properties • encouragement of real estate agents to provide a package of 'Small Property Management' to potential buyers of rural lifestyle land • provision of information to new property owners through the Council's rating system	**LLS**	**DPI (Ag), DPI (Fisheries), GLC, KGLL, Local Landholders**	**Implemented and Ongoing**	
45	Where activities are being proposed or undertaken, identify, monitor and protect sites of known significant Aboriginal and European heritage, and where there is uncertainty about the value of culture and heritage, adopt a precautionary approach	**GLC**	**NPWS, DPI (Crown Lands), LLS, OEH, KLALC**	**Unknown**	
46	Engage with local Aboriginal communities to identify key water and landscape related environmental, social, cultural and economic values and priorities for protection	**KLALC**	**OEH, NPWS, LLS, DPI (Marine Parks), GLC**	**Unknown**	
47	Incorporate information regarding local Aboriginal people's cultural history and their connections to land and water into educational material—the material to be used by the local community and visitors to the catchment	**KLALC**	**OEH, NPWS, LLS, DPI (Marine Parks), GLC**	**Unknown**	
48	Engage with local Aboriginal communities to incorporate, where appropriate, traditional land management knowledge into NRM programs	**OEH**	**GLC, KLALC**	**Unknown**	

49	Implement the Tops to Lakes Initiative; monitor and report on outcomes; review and update, as necessary	**GLC**	**LLS**	**In progress**	The Tops to Lakes initiative has formed the basis of the Karuah-Borland Landcare Agreement. Development of a Tops to Coast Wildlife Corridors Plan has been incorporated into the Midcoast Council Biodiversity Framework (Action 5.2.2)
50	In collaboration with private landholders, utilise incentive and engagement mechanisms to protect and rehabilitate threatened species, ecological communities, areas of high biodiversity values, and to create vegetation corridors	**LLS**	**DPI (Fisheries), GLC, KGLL, Local Landholders**	**Unknown**	
51	Continue to investigate and implement opportunities to protect, restore and rehabilitate ecological values of State Forest	**Forestry Corporation**		**Unknown**	
52	Investigate and implement opportunities to foster the active management of native vegetation on private land for multi-use outcomes, which include the maintenance and restoration of biodiversity and protection water quality values. Opportunities could include carbon farming and timber production	**LLS Network**	**Local Landholders, DPI (Ag) Hunter Farm Forestry**	**Unknown**	

53	Support management of private native forests in accordance with Forest Stewardship Council Codes of Practice. Develop and implement an ecological thinning code of practice for even-aged derived forests to optimise production and biodiversity outcomes	**LLS**	**DPI (Ag), GLC, Local Landholders**	**Unknown**	
54	Eradicate weeds of national significance and environmental weeds that have a limited distribution within the Karuah River Catchment	**MNCWCC**	**GLC, PSC, LLS, Forestry Corporation, NPWS, Duralie Coal, Hunter Water, Local Landholders**	**Implemented and Ongoing**	Remove wording regarding eradication as its not achievable
55	Continue to work with local landholders and the community to strategically control and reduce weed impacts on farming land and in the natural environment	**MNCWCC**	**GLC, LLS, Local Landholders**	**Implemented and Ongoing**	
56	Work collaboratively with multiple landholders and agencies to establish a prioritised and cross-tenure approach to monitoring and managing terrestrial vertebrate pests within the Catchment (and across the Great Lakes LGA). The approach should be consistent with state and regional management plans and priorities	**MNCWCC**	**GLC, LLS, OEH, DPI (Ag), Forestry Corporation, NPWS, Crown Lands, Local Landholders**	**Implemented and Ongoing**	
57	Work collaboratively with multiple landholders and agencies to establish a prioritised and cross-tenure approach to managing invasive weeds within the Catchment (and across the Great Lakes LGA). The approach should be consistent with state and regional management plans and priorities	**MNCWCC**	**GLC, PSC, LLS, OEH, DPI (Ag), Forestry Corporation, NPWS, Crown Lands, Local Landholders**	**Implemented and Ongoing**	

58	Protect, maintain and restore habitat adjoining marine sanctuary areas within the Karuah River Catchment to complement aquatic and terrestrial biodiversity conservation	**DPI (Marine Parks)**	**LLS, DPI (Fisheries), OEH, NPWS, Forestry Corporation, NPWS, GLC, PSC, Crown Lands**	**Unknown**	being addressed through MEMS program
59	Install and maintain effective fish-ways that are in line with identified DPI (Fisheries) priorities	**DPI (Fisheries)**	**GLC**	**In progress**	MCC partner with DPI to fix identified high-risk barriers to fish passage. Stroud Weir currently undergoing an upgrade
60	Investigate options for the monitoring of the recreational fishing catch	**DPI (Fisheries)**	**Fishing Clubs**	**Unknown**	
61	Undertake a platypus community awareness program and platypus status assessments	**MCW Landholders**	**Manning Great Lakes PACT, GLC, OEH, Local**	**Not commenced**	MCW now a part of MCC. MCC was a partner to an unsuccessful ARC grant to monitor Platypus populations in our LGA in 2021. eDNA assessment of some key rivers in Karuah planned for mid 2022 .
62	Promote the importance of seagrass, saltmarsh, mangrove and other aquatic habitats, and promote their protection to stakeholders and the general community	**DPI (Marine Parks)**	**DPI (Fisheries), GLC**	**Unknown**	DPI/DPIE regularly contribute to community events and the annual Report Card.
63	Encourage landholders to undertake bushfire management training, such as the 'Hotspots Program', to encourage burning regimes sensitive to ecological needs	**NSW Rural Fire Service**	**Nature Conservation Council NSW, LLS, Lower Hunter BFMC, Local Landholders**	**Unknown**	RFS partner to recent successful grant to support landholders undertake bushfire management training. Stroud community will be a key focus of this project
64	Maintain ecological burning programs to promote critical ecological processes and minimise the risk of high intensity wildfire	**Forestry Corporation**	**NPWS**	**Unknown**	
65	Improve the capacity and mechanisms within Council to facilitate improved environmental management and rehabilitation of roadside environments	**GLC**	**PSC, HCED**	**Not commenced**	

66	Develop and implement an over-arching biodiversity strategy for the Great Lakes LGA. Monitor and report on the implementation of the strategy and coordinate reviews and updates	**GLC**	**HCED, NPWS, OEH, DPI (Fisheries)**	**complete**	Biodiversity Framework adopted in 2021
67	Ensure that native vegetation clearing on private land (including private native forestry) complies with statutory controls and regulations	**OEH**	**LLS**	**Implemented and Ongoing**	
68	Adopt and implement a model NRM clause for terrestrial biodiversity in the Great Lakes Local Environment Plan (LEP)	**GLC**	**HCED**	**Not commenced**	
69	Progress the development of a Great Lakes vegetation classification scheme and fine-scale, accurate vegetation community mapping. Review and update as necessary	**GLC**	**HCED**	**Implemented and Ongoing**	Significant portion of the Karuah river catchment mapped in 2021
70	Explore and implement collaborative opportunities to expand and coordinate flora, fauna, and endangered ecological community monitoring to be undertaken by individual stakeholders	**GLC**	**HCED, Forestry Corporation, NPWS, Duralie Coal, OEH, Research Institutions**	**Not commenced**	some initial opportunities explored, but no formal program currently in place.
71	Develop and implement a strategic biodiversity and assessment program to monitor and assess the effectiveness of pre-harvesting ecological mitigation strategies. Amend ecological management programs as appropriate	**Forestry Corporation**		**Unknown**	
72	Develop a Great Lakes Catchment Landscape Report Card: (a) utilising tools such as Land for Wildlife and native vegetation condition assessments, and (b) report on Landscape Condition to the community and stakeholders every five years.	**GLC**	**HCED, LLS**	**Not commenced**	
73	Continue to investigate the threats posed to different landscapes and ecosystems by climate change and sea level rise, as well as the implementation of mitigation and adaptation options	**LLS**	**NPWS, OEH, Crown Lands, DPI (NoW), DPI (Fisheries), DPI (Marine Parks), Research Institutions**	**Unknown**	

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APPENDIX D
STAGE 1 STAKEHOLDER WORKSHOP SUMMARY

OVERVIEW

A Stakeholder Engagement Workshop for the CMP was held on 23 March 2022, which included both a Technical Working Group and a Council Internal Working Group component. This workshop was an opportunity for stakeholders to contribute and have their say regarding the planning for, and implementation of, the CMP. The purpose of the workshop was to:

- Communicate the strategic context and drivers of the CMP;
- Identify key coastal management threats and risks across the study area, including historical, present day and emerging/future; and
- Identify any tacit knowledge or non-documented issues and/or risks.

In total, 19 stakeholders attended the day both virtually and in person from a number of different organisations, including Council, NSW Department of Planning and Environment (DPE), Local Land Services (LLS), Transport for NSW (TfNSW) Maritime, NSW Department of Primary Industries (DPI), DPI Fisheries, NSW National Parks and Wildlife Service (NPWS), Crown Lands, Landcare, University of Newcastle and the University of New South Wales.

DISCUSSION FORUM

The workshop included an initial presentation on the CMP process in order to provide background and context, which was then followed by a series of open forum, round-table discussion sessions. The forum involved an assessment by the various stakeholders of the potential threats and stressors acting across the study area.

Following this, stakeholders individually assessed the potential risks, threats and stressors acting across the study area by completing and returning worksheets. As a starting point, a synthesized list of 50+ stressors was initially provided based on the findings of the Marine Estate Management Authority Threat and Risk Assessment (TARA). These stressors were divided into a series of threat categories, including, land use intensification & environmental impacts, natural hazards, public health & safety, resource use & conflict, and planning & governance. Each individual considered the risk level associated with the threats they chose to focus on, as well as potential changes to the risk level anticipated over future planning horizons. The worksheet included:

- The present risk rating of the threat in broad terms (High, Medium, Low).
- The 20 year, 50 year and 100 year risk rating of the threat in broad terms (High, Medium, Low).

In the worksheets, stakeholders also provided their particular local knowledge and noted any relevant sources of information or existing plans. All of this information was integrated into the first pass risk assessment to be undertaken as a part of this scoping study.

KEY ISSUES

Stakeholders discussed and identified a number of threats for the estuary, which are discussed in more detail in the First Pass Risk Assessment. Discussed topics included:

- QX disease in the oyster industry
- Sea-level rise
- Foreshore development
- Water quality
- Habitat migration/ squeeze
- Habitat disturbance from boat wash
- Extreme events (i.e., storms, fires, floods)
- Coastal hazards (i.e., inundation)
- Increased population growth, tourism and recreational use

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APPENDIX E
FIRST PASS RISK ASSESSMENT AND KNOWLEDGE GAP ANALYSIS

Threat	Stressor Category	ID	Stressor	Management Plans & Strategies to Address						Comments and Other Management Plans, Strategies and Programs to Address Threat	Present Day Residual Risk			Future Risk			Adequacy of Existing Information						Gap Analysis
				MEMS	Wallis Lake EOMP	Smiths Lake CZMP	Port Stephens & Myall Lakes EMP	Port Stephens Foreshore	Other↓		Likelihood	Conseq.	Present Risk	20 yr Risk	50 yr Risk	100 yr Risk	Wallis Lake	Smiths Lake	Myall Lakes	Port Stephens Foreshores	Khappinghat Estuary	Black Head Estuary	
Natural Hazards	Long Term Hazards	1.1	Tidal inundation of estuaries (i.e. sunny day flooding)	✓				✓		DPIE Tidal Inundation Mapping (OEH, 2018)	Likely	Minor	Medium	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	For Wallis, Smith, Myall, and Port Stephens the future irsk is high, and therefore a more robust assessment than the DPE inundation mapping is required: The MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment. For Khappinghat and Black Head, the risk is lower, and therefore DPE inundation mapping is fit for purpose for those estuaries.
Natural Hazards	Long Term Hazards	1.2	Estuary foreshore erosion and bank erosion	✓	✓		✓	✓		Estuary Process Studies (multiple) Lower Pindimar, Pindimar, Upper Pindimar and Bundabah Foreshore Erosion Study (BMT WBM 2010) Coastal infrastructure databases (Fisheries / Crown Lands)	Possible	Moderate	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Existing information is sufficient to inform management actions in Stage 3.
Natural Hazards	Long Term Hazards	1.3	Estuary entrance instability			✓			✓	CZMP Smiths Lake Estuary (BMT WBM 2018) The Great Lakes Coastal Hazard Study (SMEC, 2013) Balck Head Lagoon Entrance Management (Great Taree City Council, 2006)	Likely	Minor	Medium	Medium	High	High	N/A	High	N/A	N/A	Medium	High	Presently Council manages the Smiths Lake entrance in accordance with entrance management protocols. Significant information around estuary entrance morphodynamics is available.
Natural Hazards	Event Based Hazards	2.1	Coastal storm impacts - erosion		✓	✓	✓	✓	✓	Sediment & Hydrodynamic Assessment of the Lower Myall River Estuary (BMT WBM 2011) Lower Pindimar, Pindimar, Upper Pindimar and Bundabah Foreshore Erosion Study (BMT WBM 2010)	Possible	Major	High	High	High	High	Medium	Medium	Medium	High	Medium	Medium	Adequate information available around the Port Stephens Northern forshore.in Northshore of Port Stephens Lower Pindimar, Pindimar, Upper Pindimar and Bundabah Foreshore Erosion Study (BMT WBM 2010). While the level of information in the other estuaries of Wallis, Smiths and Myall is moderate.
Natural Hazards	Event Based Hazards	2.2	Coastal storm impacts - inundation		✓	✓	✓	✓	✓	DPIE Tidal Inundation Mapping (OEH, 2018) Karuah River and Stroud Floodplain Risk Management Study (Advisian 2020) . Wallis Lake Foreshore (Floodplain)Risk Management Study Flood review (WMAwater 2014) Lower Myall River and Myall Lakes Flood Study(BMT WBM 2015) The Wallis Lake Floodplain Risk Management Study – Flood Study Review (WMAWater, 2014). The Smiths Lake Flood Study (Webb, McKeown & Associates, 2008) Draft Floodplain Risk Management Study and Plan - Port Stephens (BMT WBM 2020)	Possible	Major	High	Extreme	Extreme	Extreme	High	High	High	High	Medium	Medium	Existing flood studies and FPRMSPs provide sufficient information to understand risks
Natural Hazards	Event Based Hazards	2.3	Combined coastal and catchment flooding	✓	✓	✓		✓	✓	Karuah River and Stroud Floodplain Risk Management Study (Advisian 2020). Foreshore (Floodplain) Risk Management Study(WMAwater 2014) Lower Myall River and Myall Lakes Flood Study (BMT WBM 2015) Draft Floodplain Risk Management Study and Plan - Port Stephens (BMT WBM 2020)	Possible	Major	High	Extreme	Extreme	Extreme	High	High	High	High	Medium	Medium	Stage 2 Study Needed- MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment
Natural Hazards	Event Based Hazards	2.4	Bushfire (including WQ impacts)						✓	MidCoast Council, 'How do Bushfires and Floods Impact our Waterways' (Fact Sheet) in Waterway and Catchment Report Card 2020	Rare	Major	Low	Low	Medium	Medium	High	High	High	High	High	High	Current information sufficient to inform management actions in Stage 3
Natural Hazards	Event Based Hazards	2.5	Drought						✓	NSW Draught Strategy	Unlikely	Minor	Low	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Moderate level of information is avaliable- MCC Climate Change Plans
Natural Hazards	Event Based Hazards	2.6	Tsunami						✓	NSW State Tsunami Plan 2018 (exposure exacerbated by sea level rise)	Rare	Severe	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Natural Hazards	Climate Change Impacts	3.1	Ocean/estuary temperature increase	✓					✓	Estuaries are warming at twice the rate of oceans and atmosphere (Scanes , Scanes & Rodd 2020)	Likely	Minor	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Numerous studies (Scanes & Rodd 2020) provide detail about broader estuary stressors for the region.
Natural Hazards	Climate Change Impacts	3.2	Altered storm frequency & severity	✓		✓				IPCC 6AR	Likely	Minor	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Natural Hazards	Climate Change Impacts	3.3	Altered hydrological regimes(rainfall runoff etc.)	✓					✓	IPCC 6AR MC Integrated -Water Cycle Management Strategy Our Water Our Future 2045	Possible	Moderate	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Natural Hazards	Climate Change Impacts	3.4	Sea Level Rise (SLR)	✓					✓	Smiths Lake Floodplain Risk Management Study 2015	Almost Certain	Major	See Stressors 1.1, 2.2, 2.3.										Stage 2 Study Needed- MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment
Natural Hazards	Climate Change Impacts	3.5	Long term shoreline recession due to SLR (inc drowning of low lying land)	✓					✓	IPCC 6AR Lower Pindimar, Pindimar, Upper Pindimar and Bundabah Foreshore Erosion Study (BMT WBM 2010)	Unlikely	Minor	Low	Medium	High	High	High	High	High	High	Medium	High	Current information sufficient to inform management actions in Stage 3
Natural Hazards	Climate Change Impacts	3.6	Altered salinity levels / profile	✓						IPCC 6AR	Possible	Minor	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Will be addressed through the Stage 2- MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment
Natural Hazards	Climate Change Impacts	3.7	Habitat migration & squeeze	✓					✓	Estuarine Habitat dashboard- DPI- Fisheries IPCC 6AR DPIE Tidal Inundation Mapping (OEH, 2018)	Possible	Minor	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Stage 2 Studies Needed: Coastal Wetland Mapping for Smiths Lake and Wallis Lake Estuaries MidCoast Southern Estuaries Tidal Inundation Study and Risk Assessment
Land Use Intensification & Environmental Impacts	Water pollution and sediment contamination	4.1	Urban stormwater discharge/ Industrial discharge	✓	✓	✓	✓	✓	✓	MC Integrated -Water Cycle Management Strategy Our Water Our Future 2045 North Arm Cove Stormwater Management Plan(BMT WBM 2017) The NSW Estuary Health Risk Dataset 2019 (DPIE, 2019b) NSW Estuary Temperature, pH and salinity data 2012-2020 (DPIE, 2020)	Almost Certain	Moderate	High	Extreme	Extreme	Extreme	High	High	High	High	Medium	Medium	WQIP data provides strong baseline dataset for decision making in stage 3. Addition of monitoring of human health to the existing water quality monitoring program is recommended.
Land Use Intensification & Environmental Impacts	Water pollution and sediment contamination	4.2	Sewage effluent & septic runoff	✓	✓				✓	MC Councils Waste Management strategy 2030 MC Integrated -Water Cycle Management Strategy Our Water Our Future 2045 The NSW Estuary Health Risk Dataset 2019 (DPIE, 2019b) NSW Estuary Temperature, pH and salinity data 2012-2020 (DPIE, 2020)	Possible	Moderate	Medium	Low	Low	Low	High	High	High	High	High	Medium	WQIP data provides strong baseline dataset for decision making in stage 3. Addition of monitoring of human health to the existing water quality monitoring program is recommended.
Land Use Intensification & Environmental Impacts	Water pollution and sediment contamination	4.3	Agricultural runoff	✓	✓		✓	✓	✓	Local Land Services Hunter Local Strategic Plan 2016-2021 The NSW Estuary Health Risk Dataset 2019 (DPIE, 2019b) MidCoast Rural Strategy: Agriculture and Rural Industries Background Report(2021) Waterways & Catchment Report Card (MCC 2021)	Almost Certain	Moderate	High	High	High	High	High	High	High	High	High	High	WQIP data provides strong baseline dataset for decision making in stage 3. Addition of monitoring of human health to the existing water quality monitoring program is recommended.
Land Use Intensification & Environmental Impacts	Water pollution and sediment contamination	4.4	Sediment contamination / pollution (including ASS)	✓	✓	✓	✓	✓	✓	The National Water Quality Management Strategy (NWQMS) National Acid Sulfate Soils Guidance: A synthesis	Possible	Minor	Medium	Medium	Medium	Medium	High	High	High	High	Medium	High	WQIP data provides strong baseline dataset for decision making in stage 3. Addition of monitoring of human health to the existing water quality monitoring program is recommended.
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.1	Foreshore / urban development		✓	✓	✓	✓	✓	MidCoast Destination Management Plan 2017 Foreshore Management Plan for Port Stephens - Living on the Edge(Umwelt 2009) MidCoast Council, Southern Wallis Lake Foreshore Restoration Plan (January 2020)	Possible	Moderate	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Moderate level of information is available for decisions in Stage 3 .
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.2	Clearing / disturbance of coastal wetlands, incl riparian and aquatic habitat	✓	✓	✓	✓	✓	✓	Great Lakes Council 2010, G. L. (2010) Wallis Lake Wetlands Strategy: Vision, Guiding Principles and Actions". SEPP (Coastal Management) 2018 SEPP (Vegetation in Non-Rural Areas) 2017 NSW Estuarine Habitat Dashboard (DPI)	Possible	Moderate	Medium	High	High	High	Low	Low	Medium	Medium	Medium	Medium	Stage 2 Study needed: Coastal Wetland Mapping for Smiths Lake and Wallis Lake Estuaries

Threat	Stressor Category	ID	Stressor	Management Plans & Strategies to Address						Comments and Other Management Plans, Strategies and Programs to Address Threat	Present Day Residual Risk			Future Risk			Adequacy of Existing Information						Gap Analysis
				MEMS	Wallis Lake EOMP	Smiths Lake CZMP	Port Stephens & Myall Lakes EMP	Port Stephens Foreshore	Other		Likelihood	Conseq.	Present Risk	20 yr Risk	50 yr Risk	100 yr Risk	Wallis Lake	Smiths Lake	Myall Lakes	Port Stephens Foreshores	Khappinghat Estuary	Black Head Estuary	
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.3	Clearing / disturbance of littoral rainforest habitat	✓	✓	✓	✓		✓	Great Lakes Council, G. L. 2008, State of the Environment Report (2008) SEPP (Coastal Management) 2018 Mapping Pre-clearing vegetation (PCT) layer developed as part of the NSW SVTM (June 2022)	Unlikely	Minor	Low	Low	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Risk is relatively low- no additional studies required.
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.4	Clearing / disturbance of terrestrial habitat	✓	✓		✓	✓	✓	MidCoast Biodiversity Strategy (2021) MidCoast Greening strategy(2021) Great Lakes Council, G. L. 2008, State of the Environment Report (2008) SEPP (Coastal Management) 2018 SEPP (Vegetation in Non-Rural Areas) 2017 Pre-clearing vegetation (PCT) layer developed as part of the NSW SVTM (June 2022	Possible	Minor	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.5	Introduction of invasive fauna pest / qx disease species	✓					✓	DPI Fisheries Hunter LSS MC Biodiversity Framework 2021-2030	Possible	Medium	High	Medium	Medium	Medium	Low	Low	Low	Low	Low	Medium	Although the adequacy of information is low, This stressor is addressed through DPI Fisheries - Biosecurity and Food safety . Council is addressing this stressor through - Site based control of foxes & Establishment of a cross agency deer control program for Wallis Lake
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.6	Introduction of invasive flora pest species (e.g. aquatic weeds)	✓	✓	✓	✓		✓	Weeds Management on Roads Australian Weeds Strategy 2017 MidCoast Council, Southern Wallis Lake Foreshore Restoration Plan (2020) MidCoast Council, Waterway and Catchment Report 2020 Hunter Regional Strategic Weed Management Plan 2017-2022 Garden Escapees and Other Weeds of Bushland and Reserves (2015) Hunter Regional Strategic Pest Animal Management Plan 2018-2023	Possible	Minor	Medium	Medium	Medium	Medium	High	High	High	High	High	High	Level of information is high and the Council is addressing the issue through its MCC biosecurity (weeds) program for high priority weeds and through volunteer bush regeneration and weed removal programs.
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.7	Damage, loss or disturbance of indigenous heritage (tangible or intangible)	✓	✓	✓	✓	✓	✓	AHIMS Great Lakes Council - Heritage Study 2007 MC Councils Cultural Plan 2036.	Likely	Major	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Further engagement with Traditional Owners should be undertaken during Stage 2 and 3 to determine if additional information gaps should be filled through Stage 4 actions.
Land Use Intensification & Environmental Impacts	Habitat Clearing / Disturbance	5.8	Damage, loss or disturbance of non-indigenous heritage (tangible or intangible)	✓				✓		Great Lakes Council - Heritage Study 2007 MC Councils Cultural Plan 2036.	Rare	Minor	Low	Low	Medium	Medium	High	High	High	High	Medium	High	Risk is relatively low- no additional studies required.
Land Use Intensification & Environmental Impacts	Hydrologic Modifications	6.1	Increasing groundwater extraction / use	✓	✓				✓	MidCoast Council Integrated Water Cycle Management Strategy – Our Water Our Future 2045.	Unlikely	Minor	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Risk is relatively low- no additional studies required.
Land Use Intensification & Environmental Impacts	Hydrologic Modifications	6.2	Modified freshwater flows, including water extraction	✓	✓				✓	MidCoast Council Integrated Water Cycle Management Strategy – Our Water Our Future 2045.	Rare	Minor	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	
Land Use Intensification & Environmental Impacts	Hydrologic Modifications	6.3	Catchment based Sedimentation		✓	✓	✓	✓			Possible	Moderate	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Land Use Intensification & Environmental Impacts	Hydrologic Modifications	6.4	Estuary Delta migration	✓	✓	✓	✓		✓	Sediment and Hydrodynamic Assessment of the Lower Myall River Estuary and Preparation of Management Recommendations (BMT WMB 2011)	Likely	Minor	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Land Use Intensification & Environmental Impacts	Hydrologic Modifications	6.5	Entrance management for ICOLLS	✓		✓				Great Lakes Regional Boating Plan (Transport for NSW, 2015),	Likely	Minor	Medium	Medium	High	High	N/A	Medium	N/A	N/A	Medium	Medium	Presently Council manages the entrance in accordance with entrance management protocols. Significant information around estuary entrance morphodynamics is available.
Resource Use & Conflict	Commercial fishing	7.1	Overfishing, Unsustainable fishing limit, and future productivity commercial fishing.	✓	✓				✓	FM Act 1994 and Regulation DPI-Fisheries commercial fishing licence database MEMS TARA NSW Regional Boating Plan for Port Stephens- Hunter Region 2015 NSW Regional Boating Plan for Great Lakes- Hunter Region 2015 MC- Regional Economic Development Strategy 2018-2022	Possible	Major	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	N/A	N/A	Current information sufficient to inform management actions in Stage 3
Resource Use & Conflict	Recreational Fishing	7.2	Shore and boat based line and trap fishing, hand gathering. Unsustainable recreational (social) fishing.	✓					✓	NSW Regional Boating Plan for Port Stephens- Hunter Region 2015 MidCoast Destination Management Plan (Tourism Destination Management Plan) (MidCoast Council, 2017) , NSW Regional Boating Plan for Great Lakes- Hunter Region 2015	Possible	Moderate	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Resource Use & Conflict	Recreation & Tourism	7.3	Passive recreational use	✓	✓		✓		✓	MidCoast Destination Management Plan (Tourism Destination Management Plan) (MidCoast Council, 2017)	Almost Certain	Insignificant	Medium	Medium	Medium	Medium	High	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Resource Use & Conflict	Recreation & Tourism	7.4	Anti-social behaviour and unsafe practices		✓				✓	TFNSW incident register	Rare	Minor	Low	Low	Low	Low	High	High	High	High	High	High	No study needed as risk is relatively low
Resource Use & Conflict	Access & Availability	8.1	User group conflict on waterways		✓				✓	NSW Regional Boating Plan for Port Stephens- Hunter Region 2015 MidCoast Destination Management Plan (Tourism Destination Management Plan) (MidCoast Council, 2017) ,	Likely	Minor	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Resource Use & Conflict	Access & Availability	8.2	Overcrowding / congestion of foreshore/foreshore user group conflict		✓				✓	MidCoast Destination Management Plan (Tourism Destination Management Plan) (MidCoast Council, 2017) MidCoast Council Regional Economic Development Strategy 2018-2022	Possible	Minor	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3
Resource Use & Conflict	Access & Availability	8.3	Limited or lack of foreshore and waterway access			✓			✓	Council asset database MC -Driving-on-Beaches-brochure-2022	Likely	Minor	Medium	Medium	High	High	High	High	High	High	High	High	Current information sufficient to inform management actions in Stage 3
Public Health & Safety	Public Health & Safety	9.1	Water pollution/contamination affecting human health and safety	✓							Likely	Moderate	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Current information sufficient to inform management actions in Stage 3. However, there is potential for a Stage 4 action to incorporate human health water quality program in the existing WQIP of MCC.
Public Health & Safety	Public Health & Safety	9.2	Safe, navigable waterways - Entrance bar	✓		✓			✓	TfNSW Incident database NSW Regional Boating Plan for Port Stephens- Hunter Region 2015 NSW Regional Boating Plan for Great Lakes- Hunter Region 2015 RMS Maritime Safety Plan 2017–2021 Crown Lands NSW Coastal Dredging Strategy 2019-2024	Possible	Moderate	Medium	Medium	Medium	Medium	High	High	High	High	High	High	Information already available from historical studies and existing datasets is sufficient to inform Stage 3 management actions without the need for additional studies in Stage 2
Public Health & Safety	Public Health & Safety	9.3	Public safety risk from aging and/or degraded coastal/estuary infrastructure	✓					✓	NSW Maritime Infrastructure Plan 2019-2024 Local Council Asset Management Plans	Rare	Minor	Low	Low	Medium	Medium	High	High	High	High	High	High	Risk is low and Adequacy of information is high. Existing datasets is sufficient to inform Stage 3 management actions without the need for additional studies in Stage 2.
Public Health & Safety	Public Health & Safety	9.4	Wildlife interactions	✓					✓	NSW Shark Management Strategy & SharkSmart Program, MC Biodiversity Framework 2021-2030 MidCoast Dingo/Wild Dog Management	Unlikely	Minor	Low	Low	Medium	Medium	High	High	High	High	High	High	Current information sufficient to inform management actions in Stage 3
Planning & Governance	Governance	10.1	Lack of adequate coordination between estuary councils, catchment councils and state government agencies	✓	✓	✓	✓	✓	✓	NSW Coastal Management Manual	Almost Certain	Major	Extreme	Extreme	High	High							
Planning & Governance	Governance	10.2	Lack of compliance with regulations (by users) or lack of regulation effort (by agencies)	✓	✓	✓	✓	✓	✓	MidCoast Waterway and Catchment Report(2020)	Almost Certain	Moderate	High	High	High	High							
Planning & Governance	Governance	10.3	Lack of funding for investigation and action implementation	✓	✓	✓	✓	✓	✓	NSW Coast and Estuary Grants Program	Likely	Major	High	High	High	High							
Planning & Governance	Governance	10.4	Lack of or ineffective community engagement or participation in governance	✓	✓	✓	✓	✓	✓	NSW Coastal Management Manual	Unlikely	Minor	Low	Low	Low	Low							

Threat	Stressor Category	ID	Stressor	Management Plans & Strategies to Address						Comments and Other Management Plans, Strategies and Programs to Address Threat	Present Day Residual Risk			Future Risk			Adequacy of Existing Information						Gap Analysis
				MEMS	Wallis Lake EOMP	Smiths Lake CZMP	Port Stephens & Myall Lakes EMP	Port Stephens Foreshore	Other		Likelihood	Conseq.	Present Risk	20 yr Risk	50 yr Risk	100 yr Risk	Wallis Lake	Smiths Lake	Myall Lakes	Port Stephens Foreshores	Khappinghat Estuary	Black Head Estuary	
Planning & Governance	Information Gaps	11.1	Incomplete coastal process information (including climate change impacts)								Possible	Moderate	Medium	High	High	High							
Planning & Governance	Information Gaps	11.2	Incomplete ecological information (including climate change impacts)						✓	MidCoast Biodiversity Framework 2021-2030,	Almost Certain	Moderate	High	High	High	High							
Planning & Governance	Information Gaps	11.3	Inadequate and/or incomplete European and Indigenous Heritage information						✓	MidCoast Councils Cultural Plan 2036	Unlikely	Minor	Low	Low	Low	Low							
Planning & Governance	Information Gaps	11.4	Inadequate social and economic information								Unlikely	Minor	Low	Low	Low	Low							

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